The Electrical Industry's Weekly Magazine April 4, 1960

# Electrical World

Price 50 Cents A McGraw-Hill Publication

## LILCO Plans ow-First-Cost Unit For Peaking Capacity

. . . page 28

*ansas Companies, Co-ops ool Wits; Push Sales . . . p 71*

UNIV MICROFILMS INC
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ANN ARBOR MICH C 4

**General Electric reports on developments in...TRANSMISSION**

*Recent developments in mobile transformers help utilities . . .*

# REDUCE INVESTMENT IN RESERVE CAPACITY

**TO SERVE GROWING LOADS** and to reduce transmission system investment, electric utilities are steadily increasing the size of transmission stations and the ratings of station transformers. In addition, many utilities are finding the *mobile transformer* an important tool to further reduce system investment.

**MOBILE TRANSFORMER CAPACITIES,** however, have had to expand with expanding systems. And they have.

Ten years ago, the highest-capacity mobile transformer built was rated about 6000 kva. Today, General Electric has built and sold mobile units rated as high as 40,000 kva.

Electric utilities have been quick to recognize the savings in system reserve capacity which larger capacity mobile transformers make possible. The proof? 34 percent of all mobile units (substations and transformers) in service today have been purchased in the past 3 years. And 40 percent of current General Electric sales in mobile units are mobile transformers, which have emerged as separate products with distinct applications.

Mobile transformers are being used primarily for reserve capacity, today, while the mobile substation has found its place as a maintenance tool.

**SAVINGS** that may be obtained through use of mobile transformers are often highly dramatic. Some utilities have found that mobile units pay for themselves in one year. The reasons are clear:

- One mobile transformer can serve as emergency capacity for a number of stations distributed over a wide area.
- With mobiles, existing installed capacity can be used more efficiently. Much higher loading of all station facilities is possible.
- Larger capacities available today extend use (and economies) of mobiles to a larger percentage of transformers used over an entire system.

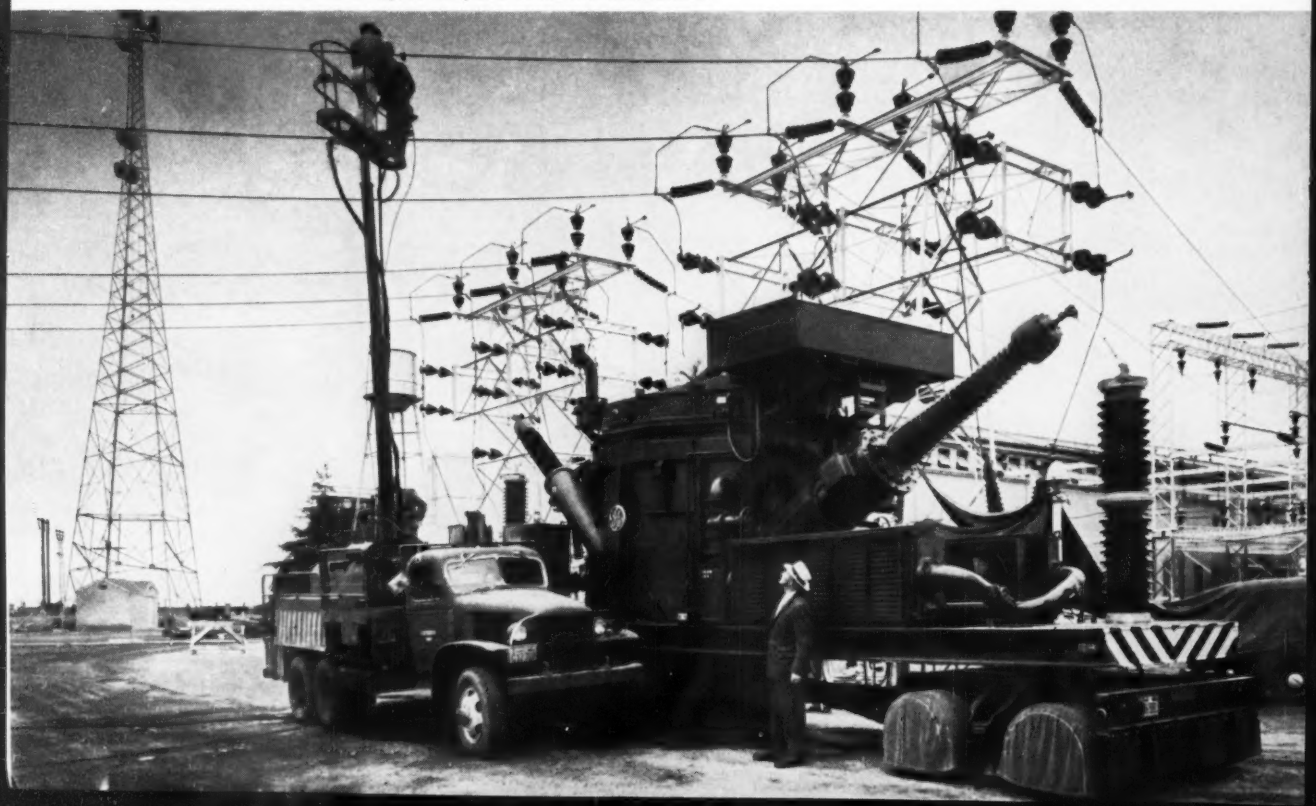
**OTHER IMPORTANT BENEFITS** causing electric utilities to look with increasing favor on mobile transformers include the *speed* with which they may be put into service in case of emergency and the *improved service continuity* they make possible, with consequent returns in customer good-will.

**NEW CONCEPTS** in design, in materials, and in manufacturing have made possible great increases in the kva capacity of mobile transformers in just the past few years. Important as these developments are, they represent only a fraction of the total effort devoted by General Electric to its most important mission: to work with electric utilities to get more power on the line and to keep the cost of power low. General Electric Co., Schenectady 5, N. Y.

604-02

GENERAL ELECTRIC

**PACIFIC GAS AND ELECTRIC** linemen tap in on high-voltage bus in initial test of G-E 40,000-kva, 230-kv mobile transformer.



# Electrical World

Vol. 153, No. 14 APRIL 4, 1960

Published for 86 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

## In This Week's Issue

p 28

p 38

CURRENT EVENTS

### New 750-Kv EHV Project Charted

Westinghouse and American Electric Power announce plans for 750-kv transmission research program.....p 24

### Hanford Power Facilities Feasible

FPC study says addition of electric power-producing facilities at reactor would be economically sound.....p 26

DISTRIBUTION

### Primary Loop Assures Shop Center Service

*F. J. Kastl, Southwestern Public Service Co*

Planning with developer yields flexible and reliable underground system with single transformer size.....p 38

GENERATION

### Consider 100-Mw Unit for Peaking

*William Welch Jr, Long Island Lighting Co*

Long Island Lighting to add economic steam capacity at Barrett Station for operation near close of 1962.....p 28

### 300-Mw Single-Unit BWR Plant Practicable

*Dr H. C. Ott and R. H. Gordon, Ebasco Services*

Study shows other boiling water cycles may ultimately prove as attractive as the dual cycle.....p 33

## Departments


| | | | | | |
|---|---|---|---|---|---|
| Editorials | 23 | Management Newsletter | 71 | Politics and Public Power | 12 |
| Electric Utility Methods | 32 | Manufacturers News | 44 | Procurement & Products | 40 |
| Electrical Week | 11 | New Equipment | 50 | Readers Service | 54 |
| Engineering Reference Sheet | 37 | News About People | 75 | Selling | 63 |
| Letters | 5 | Nuclear Notes | 14 | INDEX TO ADVERTISERS | 86 |

**LOWEST-COST**
**TRANSMISSION LINE**

Armless pole design eliminates crossarms, braces, hardware . . . saves up to one-third in material . . . more in labor of erection. Because insulator is stronger than crossarm, permits longer spans, larger conductors, greater safety margins. Requires narrowest ROW. Easiest-ever for hot-line work.

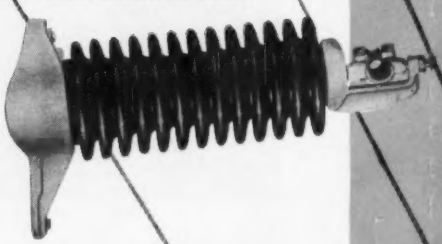
**BEST-PERFORMING**
**TRANSMISSION LINE**

Horizontal mounting of Line Post encourages uniform wetting and self cleaning, improves wet flashover values by as much as 15% over upright ratings. Eliminates contamination flashover and pole-top burning.

**BEST-LOOKING**
**TRANSMISSION LINE**

Neat, unobtrusive appearance avoids customer objection in urban and suburban residential construction. Can handle 69 kv, or higher, yet looks more like a "small" distribution line. Permanently free of RIV and TV interference, too.

# the insulator for armless transmission



Lapp Line Posts with clamp-top and integral-base-and-gain for horizontal mounting are available in voltage ratings of 35 kv, 45 kv, 55 kv, 66 kv and 88 kv. Each insulator is held by two through-bolts, and entire structure is easily assembled on the ground before erection.

**Lapp**

*Modern armless construction with Lapp Line Posts is explained in detail in the new Lapp Catalog No. 8. Write for your copy.*
*Lapp Insulator Co., Inc., LeRoy, N. Y.*

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# LETTERS

## Nicely Written, and Objective

To the Editor:

I would like to compliment you on the coverage which Electrical World gave our Annual Meeting in St. Louis recently.

Your March 7 issue gave our national meeting a nicely written, objective presentation on the activities, etc., of the four-day "get together."

Incidently, we also thought the "Report on Co-op Rates" in the same issue a nicely done Newsletter.

Of course, we here at NRECA are not in agreement with the editorial content of the Politics & Public Power column in the same issue.

I find it most enjoyable to write a letter of this type and we do appreciate the space you have given to our members.

Roger Courtland
Director Public Relations
The National Rural Electric
Cooperative Association
Washington 9, D. C.

## Engineering Students Can Be Attracted

To the Editor:

The conditions presented by Mr. Robert L. Hays' letter to the editor (EW, Jan. 25, p 3) have been more than a rumor in the minds of many college students with whom I have had contact. Mr. Hays has expressed some students' reasons why electrical engineers with utility or heavy manufacturing intent are no longer enthusiastically springing from our college freshmen or sophomore classes in reasonable proportions.

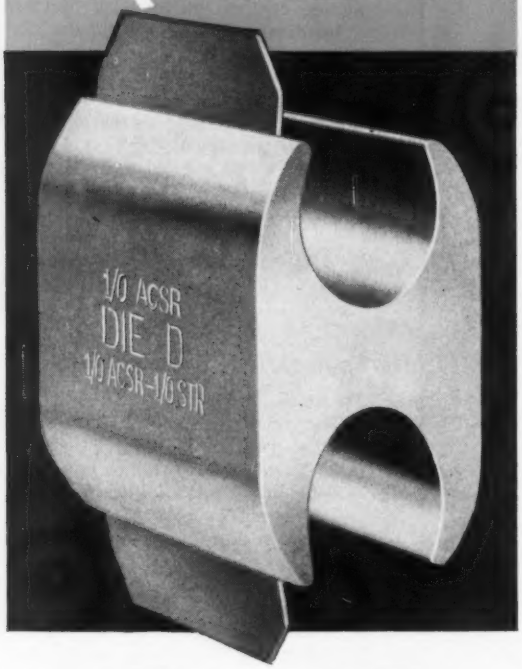
Should any inspiration be acquired before or during early university experiences it may be realistically seduced before training is too far advanced by the romance of modern progress and the rewards of individual accomplishment in other fields. These factors constitute exceedingly fine motivation. The electric utility industry has too frequently shown poor competition at this stage of training as well as at the recruitment stage.

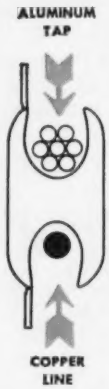
Certain sincere attempts on the part of educators and utilities to improve relationships have not been entirely successful. Some are spasmotic and therefore only partially successful. One might reasonably question the wisdom of such attempts if both the professional opportunities and the economic structures are either poorly presented or supported.

Educators once aware of the challenges and rewards offered by the power industry are being supplanted by younger men whose interest has followed student demand trends and economics more closely. In transition, certain universities have modernized or sold their experimental laboratories, and expanded training programs in other directions, wisely, necessarily, or unwisely, to meet changing conditions. Successful school management requires progress. A project or

(*Continued on page* 84)

# *new!* KEARNEY DOUBLE-TAB SQUEEZON



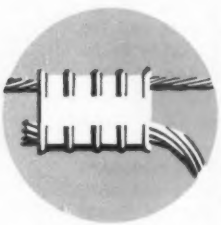




Exclusive Kearney design permits either groove to be used for line or tap. Diagram illustrates Double Tab Squeezon used to make an aluminum "step-up" tap to copper line connection.

## NOW! The Easiest Way to Make Both "Step-Up" and "Step-Down" Tap Connections on All Combinations of Copper, Aluminum and ACSR

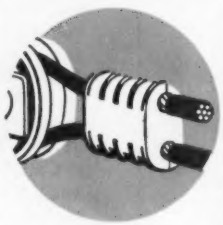
The newest, most versatile Squeezon Compression Connector. Dual, fully open groove design, exclusive with Kearney, eliminates need to thread tap conductor through fitting. Use *either* groove for line or tap . . . make "step-up" or "step-down" tap connections quickly and easily. Double Tab Squeezons speed up deadending, too. Form the loop . . . drop the conductors into the open grooves . . . and compress! On insulated wire, remove only a "Squeezon-length" of insulation!

Available in a range of size combinations for aluminum, copper or ACSR. (Write for Selector Card.) Individually packaged in handy "Snap-Open" boxes; grooves factory-filled with Kearnalex inhibitor and contact aid.



**REVERSIBLE**
The only compression connector with built-in spacer that makes *BOTH* "step-up" and "step-down" tap connections, from copper to ACSR, aluminum to ACSR, or aluminum to copper.

**MASSIVE SPACER**
Separates conductors . . . eliminates strand cutting . . . and aids in the prevention of galvanic corrosion between dissimilar conductors.



**SECONDARY DEADENDING**
Faster, easier. No threading through . . . form the loop, position Squeezon and compress! On insulated wire, strip only enough insulation to make the connection.

**"SNAP-OPEN" BOX**
Individually packaged. Box snaps apart along perforated line . . . INSTANTLY, CLEANLY . . . even with gloves! No stripping, no peeling.

**NO DISTORTION**
Squeezon groove jaws completely encircle conductor when compressed . . . provide dependable long-line, full circumference contact without distortion or damage to conductor.

*for better construction . . . safer maintenance . . . specify KEARNEY products*

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

## JAMES R. KEARNEY CORPORATION

4224-42 Clayton Avenue, St. Louis 10, Missouri

PLANTS AT: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

# You can save money on line maintenance with Graybar as your auxiliary warehouse

Need wire cutters? Pin type insulators? Guy strand? An electric impact wrench? Whether for day-to-day use or emergencies, Graybar can deliver everything you need for line maintenance — from eye bolts to completely pre-assembled fifty-foot double plank transmission crossarms.

Equally important, you can save money with Graybar as your auxiliary warehouse for maintenance materials. For one thing, you can cover your needs on a single Graybar transaction. You can save also on handling the materials. And you can lighten your maintenance inventory, because Graybar carries the most complete stocks of *any* electrical distributor.

***Start with a local call*** . . . Have your Graybar man come in. He is familiar with your problems. He knows his stock thoroughly.

| When Graybar is your auxiliary warehouse — | You save on storeroom costs<br>Reduce inventory investment<br>Insure prompt delivery<br>Step up manhour efficiency<br>Simplify bookkeeping |
|---|---|

948

**GraybaR**

Everything Electrical — GraybaR Electric Company

IN OVER 130 PRINCIPAL CITIES

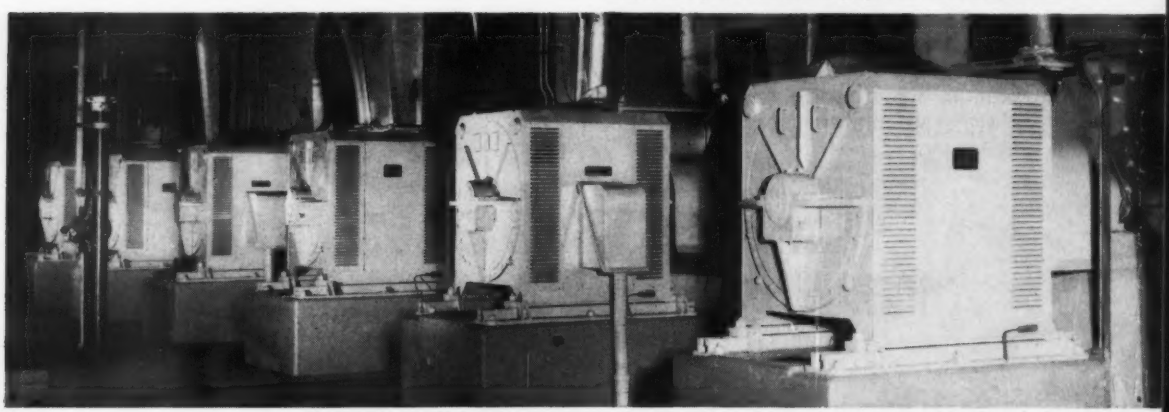
ELECTRIC COMPANY, INC.

420 Lexington Avenue, New York 17, N. Y.

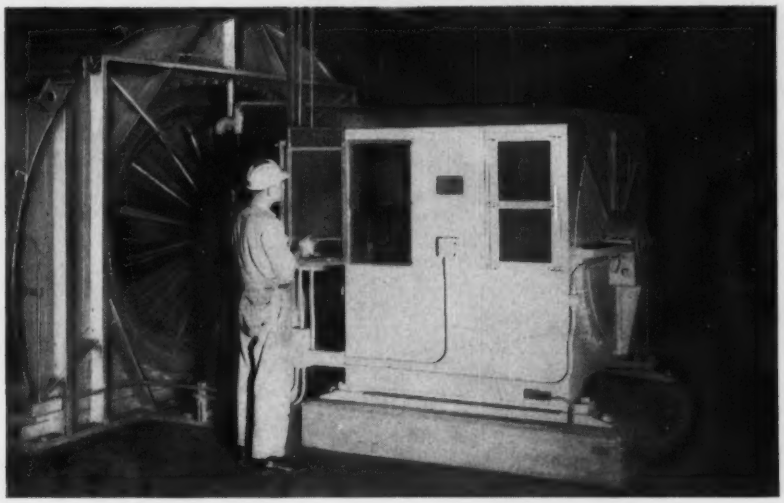
# BIG

The three 5000-hp, 2-pole Elliott motors shown above are the first of this size ever installed. Each motor drives one boiler-feed pump and one heater-feed pump. Special "easy-access" features were developed in cooperation with Detroit Edison.

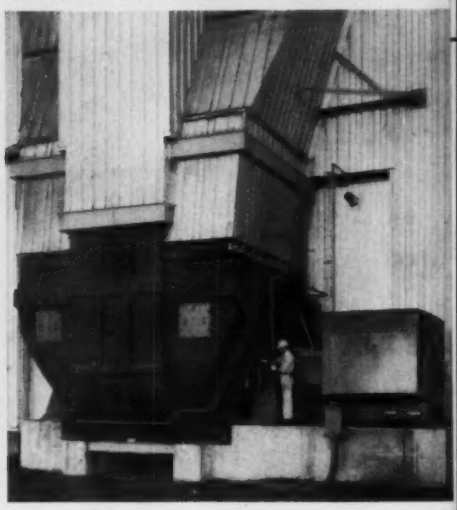
The six Elliott 600-hp, 900-rpm dripproof motors, below, are driving pulverizer mills. All auxiliary motors, 200 hp and above, are 4000-volt, Fabri-Seal insulated, designed for full voltage starting and include many features that simplify and reduce maintenance cost.



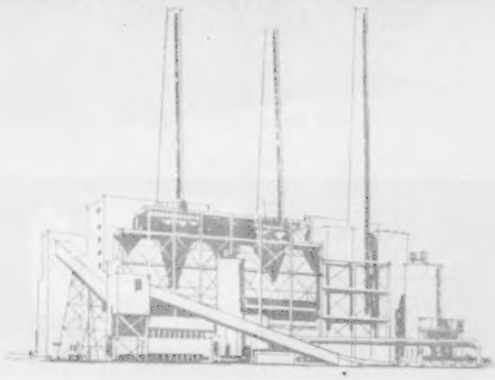
One of two 1500-hp, 900-rpm horizontal, squirrel-cage induction motors driving forced-draft fans. Operator is changing filter in hinged, swing-out "easy-access" filter panel.



One of the two Elliott 2500-hp, 600-rpm weather-protected horizontal, squirrel-cage induction motors, which drive induced-draft fans.



# ELLIOTT MOTORS



## TAILORED TO SERVE DETROIT EDISON

For River Rouge Unit No. 3 of Detroit Edison, all major auxiliary drive motors were furnished by Elliott. A list of these motors is shown at the right.

Included are three large motors that are unique in several respects:

They were the very first 5000-hp, 2-pole motors ever built.

They incorporate special "easy-access" features developed in close cooperation with Detroit Edison to meet specific and unusual requirements.

They attain new levels of super-quiet operation.

The "easy-access" requirement included the specification that two men using only ordinary hand tools could completely disassemble the motor for internal inspection without having to lift any part weighing more than 100 pounds. Working with Detroit Edison, Elliott engineers met these rigorous conditions with a design that permits fast and easy removal of bracket covers, inner baffles, filters and bearing sleeves, for internal inspection or cleaning.

Elliott motors serving the River Rouge Station are listed below. They add up to a total of 29,350 hp.

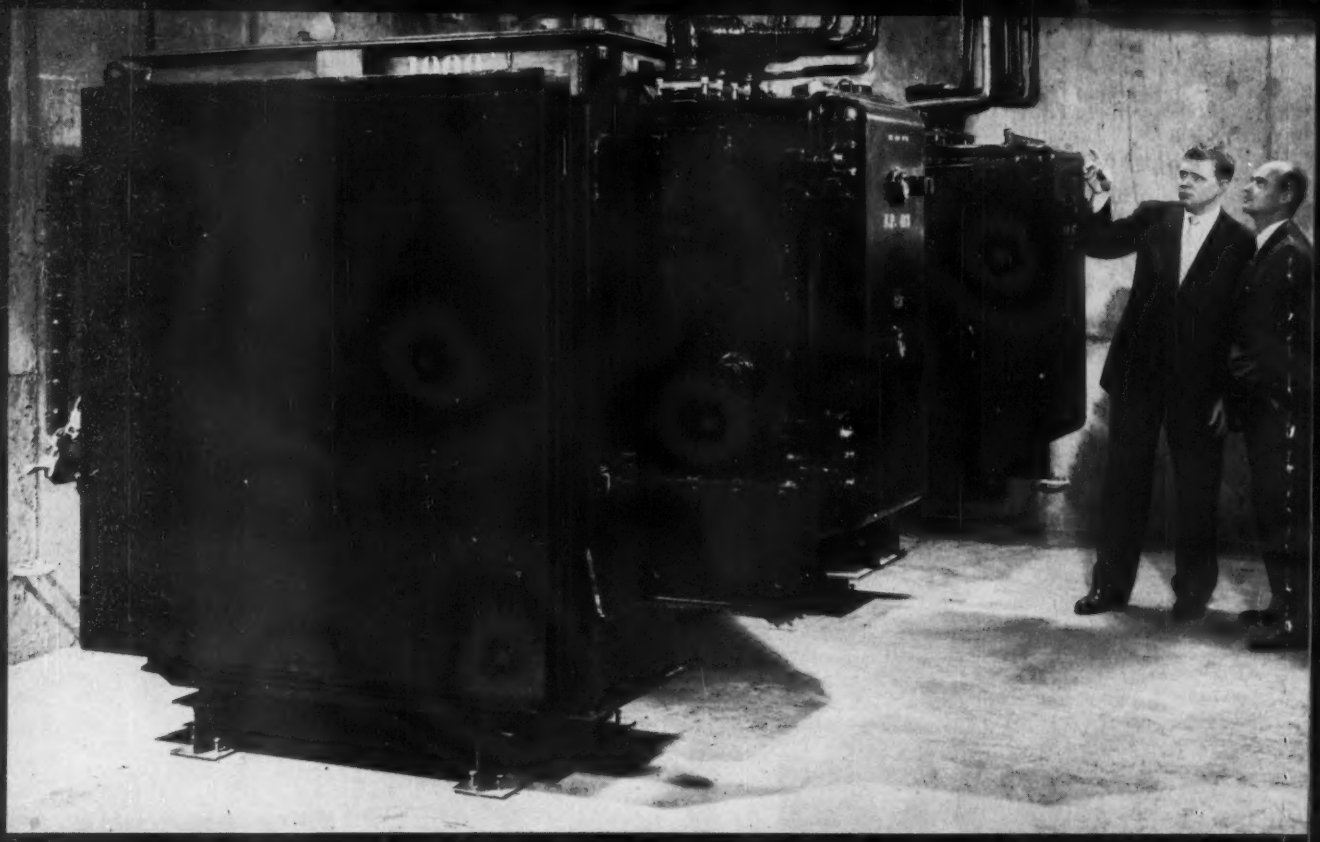
| *Number* | *Application* | *Rating* | *Speed* |
|---|---|---|---|
| 3 | Boiler-feed and Heater-feed Pumps | 5000 hp | 3600 rpm |
| 2 | Induced-draft Fans | 2500 hp | 600 rpm |
| 2 | Forced-draft Fans | 1500 hp | 900 rpm |
| 2 | Circulating Water Pumps | 600 hp | 400 rpm |
| 6 | Coal Mills | 600 hp | 900 rpm |
| 2 | General Service Water Pumps | 250 hp | 1800 rpm |
| 3 | Heater Drain Pumps | 200 hp | 3600 rpm |
| 3 | Condensate Pumps | 150 hp | 900 rpm |

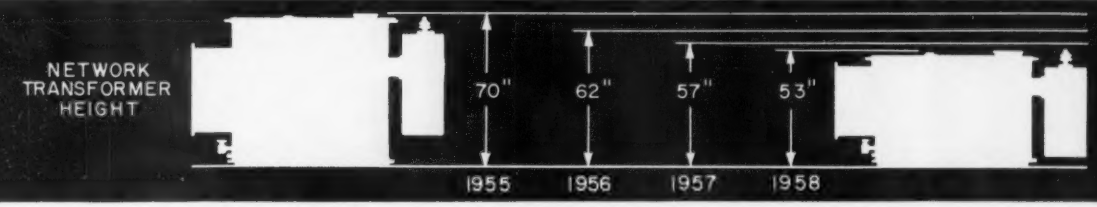
Elliott motors also drive vent fans and flue dust fans.

ELLIOTT Company

Ridgway Plant • Ridgway, Pennsylvania

RO-2






Utility and G-E engineers inspect recent Vaultmaster transformer installation. Insert shows dramatic size reductions—totalling 24%—made on 500-kva, 15-kv network transformer since 1955.

# General Electric network transformers combine new features, old reliability to pace utility requirements

Not by tradition alone has the General Electric network transformer held its unquestioned rating as the No. 1 choice of the nation's electric utilities. Utilities know that *continuous* design innovations—backed by in-service reliability—keep the G-E "Vaultmaster" ahead of the field. For example, look at these major improvements made to G-E network transformers in the past 18 months:

- **Wound Evans Core** (July, 1958)—This important development utilizes the famous G-E Spirakore* core and results in a core-and-coil that has improved characteristics, yet is smaller and lighter.

- **"Sandwich" Paint Finish** (October, 1958) Melaprene, the best paint yet found to combat corrosion damage to network transformer finish, is applied *between* the primer and finish coats to provide extra-long finish life—altogether, five paint coatings are applied compared to three coats on other network transformers.

- **Alumina Bushings** (March, 1959)—The goal of a hermetically sealed network transformer was brought one step closer with this major advance. It eliminates the need for gaskets while reducing the throat height of the Vaultmaster unit by four to six inches.

- **Nitrile Gaskets** (November, 1959)—Both the high- and low-voltage ends of G-E network transformers are now protected by nitrile rubber gaskets—superior in sealing ability and reusable without requiring cement or other adhesive.

Thinking of a network installation this year? If so, be sure you have kept up with network-transformer advancements by keeping in touch with your General Electric Sales Engineer. Or, write for Bulletin GEA-5024 to Section 484-01, General Electric Co., Schenectady 5, N. Y.

* Reg. Trade-mark of General Electric Co.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

# The Electrical Week

**LATE NEWS ▶** **Soviets design 800-Mw turbine,** according to East German magazine "Elektrie." It will be a 3,500 psi/1,076F, double-case unit.

**Washington Wire** . . . Consumers Power asks FPC for May 1 start on 50-75-Mw A-plant at Rock Point, Mich. . . Interior Dept recommends changes in Arkansas-Fryingpan project which replace one dam near Aspen, Colo., with dams at Reudi and Ashcroft . . . Senate Commerce Committee recalls bill prohibiting new Salmon River dams until fish problem is solved; amendments to it may be offered.

**Around the States** . . . Appalachian Power and IBEW agree to 4½% wage hike . . . Portland GE wins $1.9-million yearly rate hike from Oregon PUC. Commission also grants $3.5-million increase to Pacific P&L in Oregon, but Washington PUC denies PP&L's bid for 10% increase . . . Oregon commercial fisherman increase efforts to block Nez Perce . . . California gives go-ahead to California-Oregon Power to build Iron Gate Dam on Klamath River.

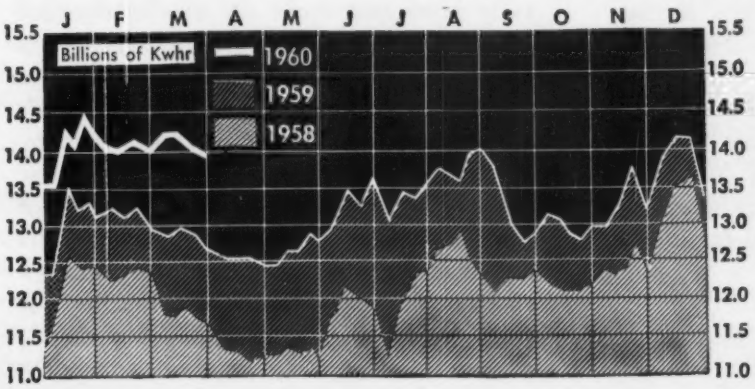
**Ohio Power buys Minerva, Ohio, municipal system.** Village utility was established in 1888, and is reputedly the world's oldest community-owned system. Price: $901,250; customers: 1,800.

**At the American Power Conference, Chicago:** John Conrad, president, S&C Electric, defends morality of profit . . . Detroit Ed Pres Walker Cisler says Russia electrically is where we were 25 years ago.

**Management changes** . . . Alphonse Aymond becomes board chairman and James Campbell president of Consumers Power . . . J. C. Friedrich named vp, manufacturing, at James R. Kearny Corp.

**Obituaries** . . . G. M. Gadsby, 76, Utah P&L chairman on March 29, and R. H. Barclay, 72, former vp, J. G. White Engineering Corp.

## WEEKLY POWER OUTPUT—Up 9.8% (Week ending Mar. 26), Kwhr 13,951,000,000




Per Cent Change From Previous Year

| | Mar. 12 | Mar. 19 | Mar. 26 |
|---|---|---|---|
| Total U. S. | + 9.8 | + 9.4 | + 9.8 |
| New Eng. | + 5.6 | + 7.2 | + 8.1 |
| Mid. Atlan. | + 8.3 | + 9.1 | +10.3 |
| Cent. Ind. | + 8.3 | + 7.9 | +10.1 |
| West Cent. | + 9.9 | + 8.0 | + 8.7 |
| Southeast | +12.5 | +12.3 | +12.7 |
| South Cent. | +10.4 | + 9.5 | + 6.4 |
| Rocky Mount. | + 8.8 | +10.1 | + 6.0 |
| Pacific | | | |
| NW | +12.7 | + 9.6 | + 4.2 |
| SW | +10.3 | + 8.1 | +10.8 |

Seasonally Adjusted Index 276.5

Week Ago 274.0 Year Ago 250.6

Source: Edison Electric Institute

# Preview of This Issue

**EVENTS** ▶ **A 750-kv test transmission line will be built in West Virginia** by American Electric Power and Westinghouse. Five other manufacturers are also participating in the project, which is expected to start testing late this year (p 24) . . . World Power Conference (in Madrid) and CIGRE Conference (in Paris) will be held a week apart (p 25) . . . FPC study claims addition of generating facilities at AEC's Hanford Reactor site is feasible (p 26) . . . Burns Creek hearings have been completed. Subcommittee may vote on the project in late April (p 27).

**ENGINEERING** ▶ **Long Island Lighting plans 100-Mw peaking turbine-generator.** The unit, which will be the next one to go in at LILCO's Barrett Station, was selected for low first cost, rather than fuel savings, and for intermittent operation on a system with daily load curves having acute peaks and valleys (p 24) . . . A 300-Mw single-unit boiling-water reactor-plant, Ebasco analysis shows, yields an energy cost only about 1-1½¢ higher than conventional station with 35¢ fuel cost (p 33) . . . Southwestern Public Service Co sectionalized primary loop assures service continuity to a new 30-acre shopping center (p 38).

**PROCUREMENT & PRODUCTS** ▶ **Signs point to further retreat in copper prices** . . . GE exec makes another plea to utilities to smooth out buying cycles . . . New Peabody

# Politics and Public Power

## TOWARD A HIGH-LEVEL DECISION—II

We noted in this space last week that certain developments in Washington, principally the recent actions of Rep Hale Boggs (D-La.), might be the first steps toward a high-level decision in government concerning the tax deductibility of certain advertising and activities purported to influence legislation or public opinion. We further noted that such a decision was sorely needed.

A recent exchange of letters between American Public Power Assn General Manager Alex Radin and Federal Trade Commission Chairman Earl Kintner (EW, March 28, p 60), though not about the tax questions specifically, underscores the need for such a decision.

In his letter Radin asked the FTC to make "a full investigation" of the Electric Companies Advertising Program (ECAP) ad series. He charged that some of the ads were "misleading, inaccurate, filled with half truths . . . a disservice to the American people and to the advertising industry itself." The APPA general manager claimed that just as American consumers are protected from false and misleading advertising about products, so too they were entitled to the same protection from ads of the so-called "institutional" type. In so doing, Radin was attacking not the suitability of the ads as legitimate business expenses, but the ads themselves . . . the ideas expressed in them.

This is at variance with the comments of other critics of the ECAP series. Sen Estes Kefauver has said on more than one occasion that he was not denying the companies the right to advertise their ideas, but merely wanted to make sure that the stockholders,

Coal Co power shovel will be able to load coal at 173 tons per scoop (p 40) . . . Alco Products puts sine-curve tubing in sodium heat exchangers for Enrico Fermi A-plant . . . Daystrom Pres describes possible future uses of computers (p 44) . . . Power fuse has large diameter bore to relieve pressures from high faults . . . Aerial beam on truck is insulated in excess of 50 kv . . . High-speed printer operates with tape-fed computer systems of other manufacturers as well as Univac (p 50).

**MANAGEMENT ▶** **Kansas power companies and co-ops have found common sales ground** in promotion of rural load. Differences in philosophy do not get in the way of teamwork and careful pre-planning of everything from sales campaign checklists to radio spots. Result: More effective and less costly rural promotion programs (p 71) . . . "Honest" workers —from wage earners to top executives—are fleecing the nation's business to the tune of $6 billion a year (p 73).

**SELLING ▶** **A utility annual report ad is in vogue now. Vogue magazine, that is.** Dayton P&L tells its story of a "first" in utility advertising on p 63.

**NEXT WEEK ▶** **Be certain to read the 20-page roundup of utility research activities.**

rather than the customers, would foot the bill "for their brainwashing."

Institutional advertising is usually concerned with the promotion of an idea, rather than a product. If FTC Chairman Kintner had gone along with Radin's request, he might have found himself under fire for allegedly attempting to throttle the free exchange of ideas. This, of course, is censorship, and it's not the kind of activity that the American people like to see their government engaged in.

Apparently, Kintner saw both the danger inherent in Radin's request, and the broader questions it raises. He answered Radin by telling him that such investigations aren't the responsibility of the FTC, but should instead be considered by Congress. "This advertising is not directed toward promoting the sale of the advertiser's product. Instead, it is directed to the reader in his capacity as a voter . . . The representations in the advertisements deal primarily with questions of a political nature, which are of a type for the Congress, rather than this agency to decide."

Kintner's point is well taken, for it goes right to the heart of the matter: The questions revolving around the ECAP ads are not merely matters of proper business expenses for tax or accounting purposes, as both the Internal Revenue Service and the Federal Power Commission have separately maintained, but rather larger ones involving Constitutional rights.

For this reason, they must be resolved at the "highest levels of government." The Radin-Kintner letters have helped make this abundantly clear.

# Nuclear Notes

**Cheaper nuclear plant construction** through use of lower cost steels is foreseen by a U. S. Steel-GE study. Savings may run as high as $4 million. The study indicates that relatively inexpensive carbon and low-alloy steels may replace expensive special metals, such as stainless steel, and do the job better.

**AEC hearing this Friday** will consider safety aspects of the 75-Mw sodium graphite reactor plant planned by Nebraska's Consumers Public Power District. The AEC will own the Hallam reactor.

**Advisory Committee of the AEC has questioned Pacific Gas & Electric's** pressure suppression plan as unproved. The planners hope to cut size and cost of the containment vessel for the proposed boiling water reactor plant on Humbolt Bay with this design. The construction application comes up for AEC hearing April 14.

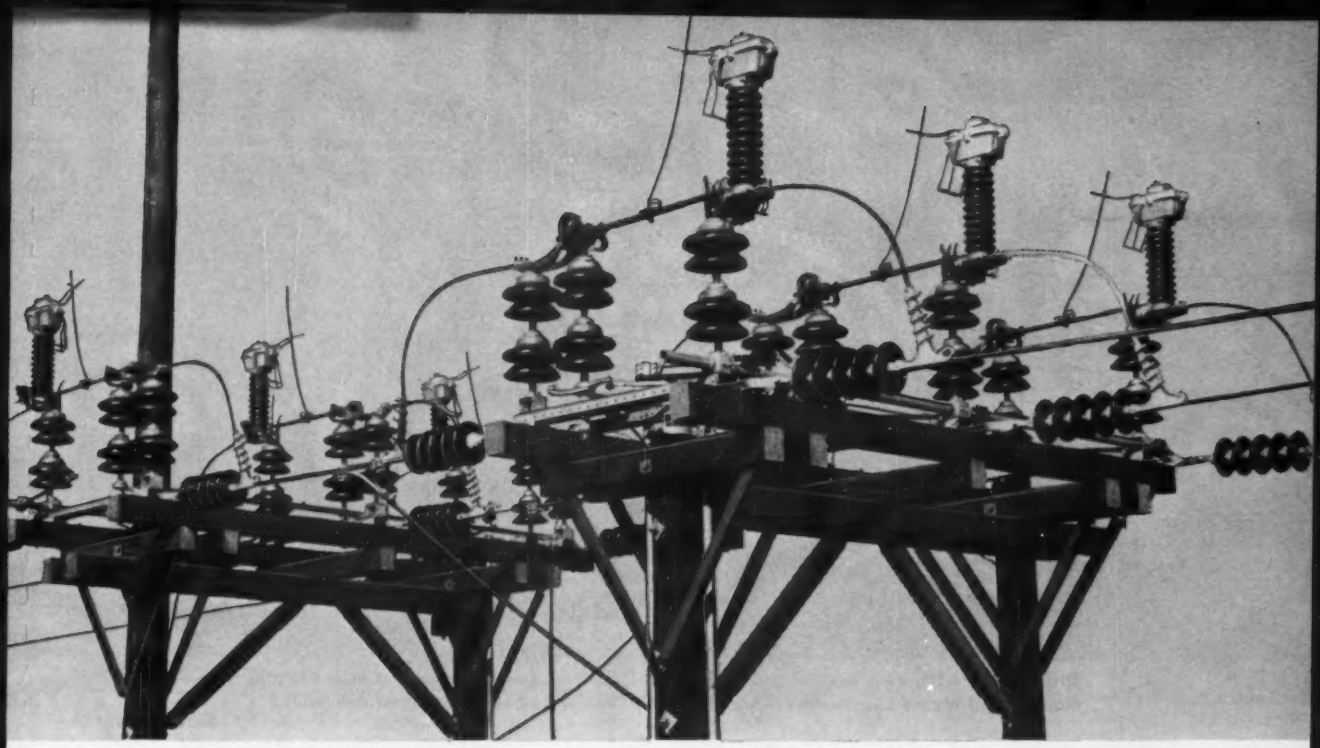
**Nuclear Congress and Atomic Exposition opens today** in New York's Coliseum. Walker L. Cisler, president of Detroit Edison, will speak Wednesday on development of nuclear power in the '60's.

**Vallecitos reactor (VBWR) should go critical again in May.** GE engineers hope to raise its specific power from 30 to 65 kw per lb enriched uranium oxide fuel through modifications now past their halfway mark. Adding a second 10,000-gpm secondary recirculating pump and quadrupling pump discharge pressure to 100 psi will improve coolant water flow. This will hinder formation of air bubbles which slow neutron reaction, hence will raise reactor power. GE also let a contract for a $1-million chemical and metallurgical lab at Vallecitos, due for completion in early fall.

**Promising fuel,** until recently a "sleeper," is uranium monocarbide, reports Battelle Memorial Institute. Research shows its properties should enable the monocarbide form to compete with metallic uranium and the dioxide now in use.

**Existing waste disposal sites will be studied** for the AEC by Cleveland Pneumatic Industries as part of "the Commission's policy of continuing reappraisal of the safety of its waste disposal measures." Both sites are about 50 miles off the California coast. 14,000 curies of radioactivity have been dumped since 1946 in one off San Francisco. The other off Santa Barbara has much lower radioactivity.

**Books** made available in March by the AEC include "Proceedings of the 1959 Symposium on Low-Temperature Nuclear Process Heat" and "Power Cost Normalization Studies, Civilian Power Reactor Program—1959." The AEC's Idaho Falls office has available a technical fact sheet on SPERT-II, which went critical on March 11.



**THESE L-M 69 kv OIL INTERRUPTERS,** mounted on L-M PV switches, provide low-cost interruption for the Grand Valley Rural Power Line substation tap of Public Service Company of Colorado.

# L-M Oil Interrupters Provide Low-Cost Load Interruption for Public Service of Colorado

## L-M Type PV air-break switches and high-voltage oil interrupters were installed for Grand Valley tap of Public Service Company of Colorado at transmission line tie

The Grand Junction and the Cameo steam generating plants of Public Service Company of Colorado are tied together by a 69 kv transmission loop 45 miles long. At the Grand Valley Rural Power Lines substation tap, 15 miles from the Cameo plant, the two lines are tied together by means of two gang-operated L-M Type PV air-break switches equipped with oil interrupters on both sides of the substation tap. With L-M oil interrupters, the switches sectionalize the line on either side without disturbing power flow to this substation.

### Increased Flexibility at Minimum Cost

L-M OIL INTERRUPTERS provide a load-interrupting means at the lowest possible cost. By installing L-M Type PV air-break switches and oil interrupters, Public Service Company of Colorado typfies utilities who are cutting costs without sacrificing quality and dependability on switching problems.

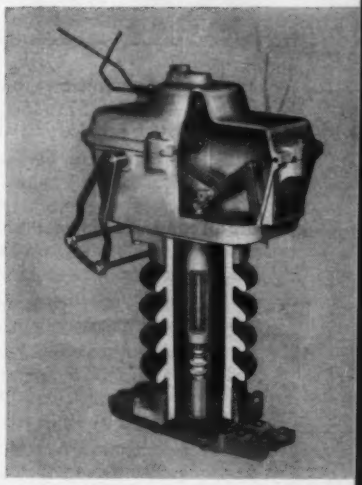
L-M's oil interrupters have been specifically designed to provide a low-cost means of picking up or interrupting load currents, line charging currents and magnetizing currents. They can be mounted on new or existing Type PV vertical air-break switches, with no change in the electrical clearances or phase spacing.

### Complete Range of Ratings

L-M oil interrupters are available in voltage ratings of 23, 34.5, 56 and 69 kv. All have continuous current ratings of 600 amperes at power factors as low as 70%, with momentary rating of 40,000 amps for 10 cycles and 25,000 amps for 4 seconds.

### Get Complete Information

Ask your L-M Field Engineer for complete information on L-M oil interrupters. He has a cutaway sample to show you. Or write direct to Line Material Industries, Milwaukee 1, Wis.



**Be sure you see this cutaway sample!** With it, your L-M Field Engineer can demonstrate the construction and operation of this excellent, economical Line Material load break device.

**LINE MATERIAL® Industries** *Power Switching Equipment*

McGRAW-EDISON COMPANY

435

DISTRIBUTION TRANSFORMERS • RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS
POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

McGRAW EDISON

**LINE MATERIAL'S own fleet of trucks delivers many Round-Wound transformers to warehouses. Inventories are maintained at levels that assure you of 24-hour transformer deliveries.**

# L-M Provides 24-Hour Stock Delivery For Most Round-Wound® Transformers

## Complete inventory of Round-Wound Transformers tailored to your requirements is just a telephone call away.

by **A. R. WAEHNER**
Director, Transformer Product Sales
Line Material Industries

We organize and maintain transformer warehouses for just one purpose—service for you. A total of 57 individual warehouses are strategically located throughout the country to provide you with 24-hour Round-Wound transformer delivery.

The inventory of this stock network is a precise calculation based upon statistical facts. The kva and voltage ratings, the type of transformer you use on your system, your projected needs and your historic and seasonal buying patterns are all considered in establishing each Round-Wound stock. A warehouse stocked with the transformers you need is near you, ready to ship transformers to you in the size and type you require.

Inventory reporting is quick and concise. Stocks are replaced almost as quickly as transformers are shipped.

All warehouses are linked together by means of a teletype network. If you order a size or type temporarily out of stock, a neighboring warehouse will most likely have it. Your Round-Wound requirement can be started on its way to you within minutes. You still get 24-hour service.

All L-M Round-Wound transformers are crated for protection and ease of handling. The base of the crate serves as a fork lift pallet. The crate is not supported by the transformer it protects. You can stack L-M Round-Wound transformers on top of each other, saving much valuable space in your warehouse.

**Get Complete Information** . . . Call your L-M Field Engineer and get complete information on the transformer stocks and warehouse facilities at your disposal. The better acquainted you become with L-M warehouses, the more service we can offer you.

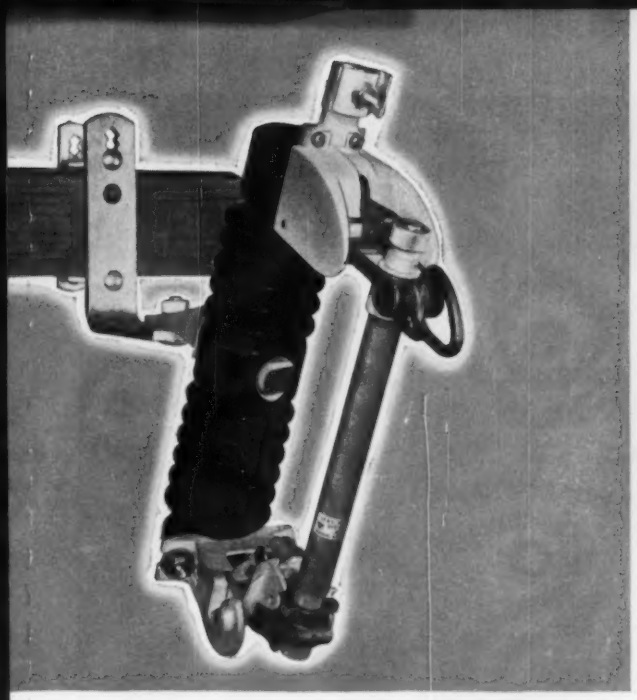
**Each Line Material Round-Wound transformer has its performance data, test results and other pertinent data recorded on an IBM card. This information is microfilmed so that it is available to you at any time.**

**LINE MATERIAL Industries** *Transformers*

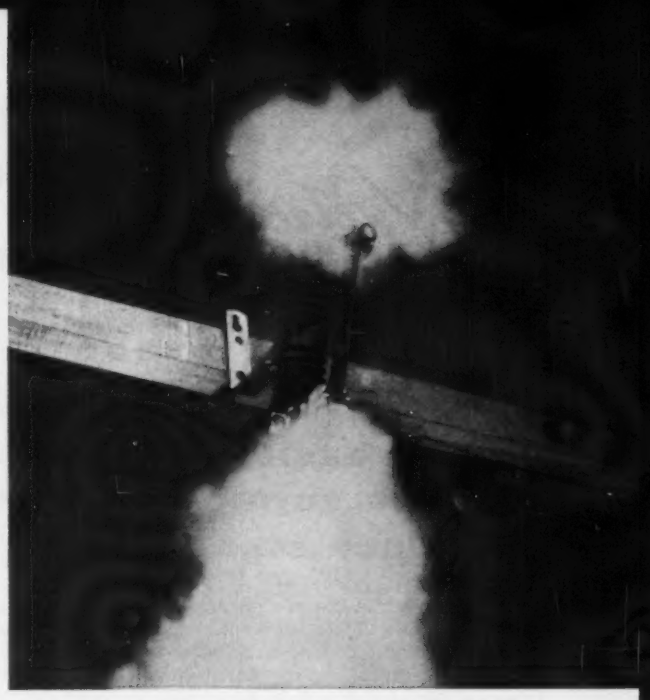
McGRAW-EDISON COMPANY

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS
POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

McGRAW EDISON



**LINE MATERIAL** concentrates all engineering, testing and manufacturing efforts in one direction—*highest quality equipment for the electric power industry.* And L-M came to you to find what you wanted in the best possible open type fuse cutout. The New LMO incorporates every important feature you asked for.



**A 240,000 kva TEST** on a 15 kv 100 ampere Type LMO Distribution Cutout at L-M's Thomas A. Edison Short Circuit Laboratory. This cutout repeatedly interrupts 16,000 ampere faults. Many tests like this prove the LMO cutout *Totally Tested* under all possible operating conditions.

# This New Totally Tested Distribution Cutout Has All Features Electric Utilities Wanted

**Drawing upon its more than 35 years experience in the engineering, testing and manufacture of distribution fuse cutouts, L-M has produced the new Type LMO open type fuse cutout.**

Totally Tested in L-M's Thomas A. Edison Short Circuit Laboratory at Franksville, Wisconsin, with hundreds of tests, the new Type LMO has proved reliability, proved interrupting capacity and proved safety through its entire operating range.

The new Type LMO distribution fuse cutout has all the important features you asked for. Features heading the list:

1. Non-ferrous construction
2. Positive latching
3. High interrupting capacity
4. Rugged multiple contacts
5. Complete birdproofing
6. Choice of terminals—aluminum or bronze
7. Spring loaded interlocking flipper

**Get Complete Information.** Ask your Field Engineer to show you: the sample of the new Type LMO cutout; the Type LMO Bulletin No. FC3; the Type LMO Movie. Contact your L-M Field Engineer or write Line Material Industries, Milwaukee 1, Wis. In Canada: CLM Industries, McGraw-Edison (Canada) Ltd., Toronto 13, Can.

**TYPE LMO RATINGS**

| VOLTAGE RATING KV | CURRENT RATING AMPS | INTERRUPTING CAPACITY AMPERES—ASYMMETRICAL | | | |
|---|---|---|---|---|---|
| | | HEAVY-DUTY | | EXTRA-HEAVY-DUTY | |
| | | Non-Expendable Cap | Expendable Cap | Non-Expendable Cap | Expendable Cap |
| 7.8 | 100 | 5000 | 10000 | 10000 | 20000 |
| 15 | 100 | 4000 | 8000 | 8000 | 16000 |
| 27 | 100 | 3000 | 6000 | — | — |

Interchangeable Fuseholders: ratings may be changed simply by changing the fuseholder. Choice of heavy-duty or extra-heavy-duty fuseholders; 200-ampere disconnecting blade; link-break fuseholder. This interchangeability offers convenience and savings in labor, material, and stocking costs.

**LINE MATERIAL Industries**

McGRAW-EDISON COMPANY

**SPECIALISTS IN DISTRIBUTION EQUIPMENT**

434

DISTRIBUTION TRANSFORMERS • RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

# Natvar TERAGLAS*

## A NEW CLASS B INSULATION HAS RESILIENT WEAVE AND HIGH DIELECTRIC STRENGTH UNDER STRETCH

Natvar Teraglas is a new flexible insulating material comprising a base fabric, woven from polyester (polyethylene terephthalate, or "Dacron") warp yarns and continuous filament glass filler yarns, coated with an improved varnish, possessing exceptional dielectric strength under elongation. It will withstand Class B (130°C) operating temperatures.

In view of the higher dielectric strength of Natvar Teraglas compared to bias varnished cambric, thinner sections or fewer layers may be used to provide the voltage breakdown protection desired. Consequently, at comparable tape prices, a significant saving may be realized in production costs, while permitting up-grading to Class B (130°C) temperatures.

Natvar Teraglas is available in two thicknesses, .010" and .012"—in tapes, in full width rolls (36"), or in sheets. Ask for Data Sheet and Samples.

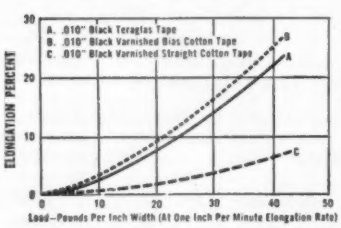
Natvar Teraglas will prove advantageous in many applications — for insulating motors, generators, transformers, cables, switchgear, busbars, and other apparatus and equipment where resiliency and high dielectric strength are desirable.

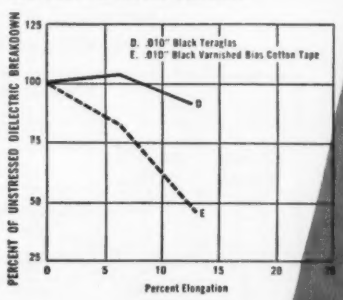
### TYPICAL DATA

| Physical Properties: | | .010" | .012" |
|---|---|---|---|
| Approximate weight per sq. yd., lbs. | | 0.54 | .62 |
| Breaking Strength lbs./in. width, | Warp | 45 | 45 |
| | Filler | 100 | 100 |
| Tear Strength, grams | Warp | Over 1000 | Over 1000 |
| | Filler | Over 1000 | Over 1000 |
| Elongation, % (Under 25 lbs./in. width—3 minutes) | | 7.5 | 7.5 |

| Electrical Properties: | .010" | .012" |
|---|---|---|
| Electric Breakdown Strength (C48-23-50 V/M) | 1600 | 1600 |
| Electric Breakdown Strength (Under 6% stretch) | 1600 | 1600 |
| Electric Breakdown Strength (Under 12% Stretch) | 1450 | 1450 |
| Power Factor, %, at 80° C-50 V/M-60 c.p.s. | 2.5 | 2.5 |

LOAD-ELONGATION CHARACTERISTICS FOR NATVAR BLACK TERAGLAS


A. .010" Black Teraglas Tape
B. .010" Black Varnished Bias Cotton Tape
C. .010" Black Varnished Straight Cotton Tape
ELONGATION PERCENT
Load—Pounds Per Inch Width (At One Inch Per Minute Elongation Rate)


D. .010" Black Teraglas
E. .010" Black Varnished Bias Cotton Tape
PERCENT OF UNSTRESSED DIELECTRIC BREAKDOWN
Percent Elongation

*Trademark applied for.

## Natvar Products

- Varnished cambric—sheet and tape
- Varnished canvas and duck—sheet and tape
- Varnished silk and special rayon—sheet and tape
- Varnished papers—rope and kraft—sheet and tape
- Varnished, silicone varnished and silicone rubber coated Fiberglas*—sheet and tape
- Slot cell combinations, Aboglas®
- Teraglas**
- Isoglas® sheet and tape
- Isolastane® sheet, tape, tubing and sleeving
- Vinyl coated and silicone rubber coated Fiberglas tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

*TM (Reg. U.S. Pat. Off.) OCF Corp.
**Trademark applied for.

***We will be very happy to supply information on any of our products on request.***

## NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

TELEPHONE FULTON 8-8800

CABLE ADDRESS NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

# JOSLYN

## NEW 400-WATT BUILT-IN-BALLAST MERCURY LUMINAIRE

# MV-141

- Streamlined Design
- Rugged—Light in Weight
- With or Without Photo Control
- Small Profile—Low Wind Resistance
- Distinctive Housing—Hydraulically Pressed

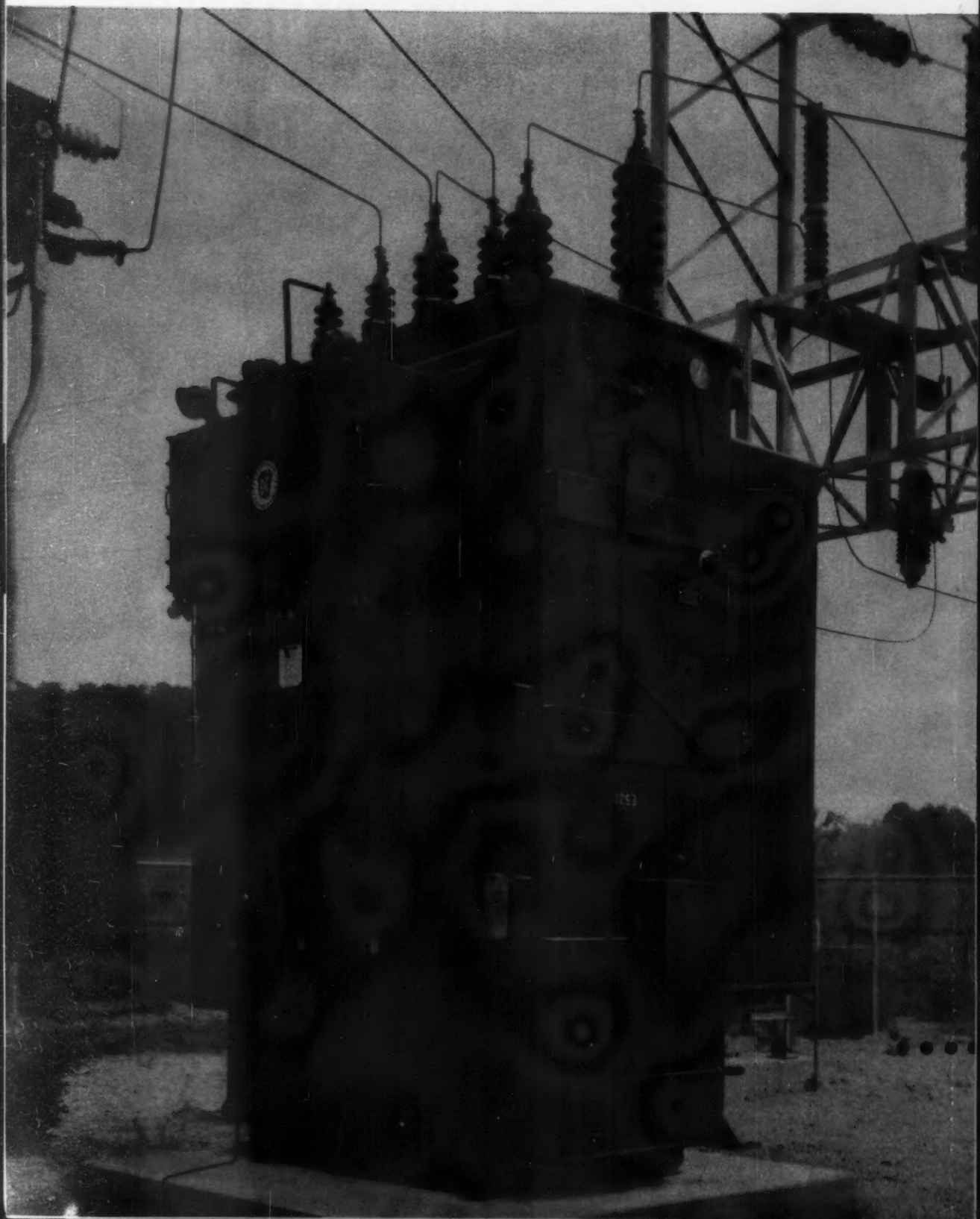
*For Details ask for Bulletin J 2-116*

LIVE BETTER ELECTRICALLY

paralleling electrical progress for 57 years!

**JOSLYN** MFG. AND SUPPLY CO.
155 North Wacker Drive · Chicago 6, Illinois

# Pennsylvania phase-isolated LTC



# Transformers offer you the ECONOMY of 3-phase installation plus the QUALITY of single-phase regulation

The Pennsylvania Phase-Isolated LTC Transformer is actually a seven-in-one package. It combines *one* three-phase transformer, *three* single-phase LTC regulators and *three* regulator by-pass assemblies. Though the initial cost is only slightly more than the cost of a conventional three-phase transformer, a real and substantial *overall* cost saving can be made. Installing a phase-isolated LTC transformer requires less space and costs less than a conventional seven-piece installation by an amount equal approximately to the sum of the following:

. . . The cost of extra supports (foundations and switch structures),

. . . The extra cost of handling separate pieces of equipment, including transportation and mounting,

. . . The cost of labor and materials for interconnection between the separate items,

. . . The design cost for the multi-unit layout.

But, installation savings are not the only savings to be realized. Through independent single-phase regulation, distribution circuit capacity can be released and revenue increased.

With independent phase regulation, the maximum and minimum voltage extremes over the three phases can be reduced. This permits heavier loading or longer feeders without exceeding established voltage limits.

With a reduced range of voltage variation, average voltage is higher. This produces an increase in revenue from voltage-sensitive loads.

For further information on the application of Pennsylvania Phase-Isolated LTC Transformers, write on your company letterhead for a copy of descriptive booklet No. 591. Address Power Transformer Sales, Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW EDISON

| Pennsylvania Phase-Isolated Three-Phase Transformers with 20% regulation in 32 steps are available in the following kva and voltage ratings: | | |
|---|---|---|
| **BIL** | **LOW VOLTAGE** | **KVA** |
| 75 kv | 4160Y/2400 or 4360Y/2520 volts | 1000 kva thru 2500/3125 kva incl. |
| 95 kv | 8320Y/4800 or 8720Y/5040 volts | 1000 kva thru 5000/6250 kva incl. |
| 110 kv | 12470Y/7200 or 13090Y/7560 or 13200Y/7620 or 13800Y/7980 volts | 1000 kva thru 7500/9375 kva incl. |
| Note: Other voltage and kva ratings can be secured under special conditions. | | |

● ● ● 3750-kva (future FA rating of 4687 kva), Phase-Isolated LTC transformer installation at the New Glarus Substation of the Wisconsin Power and Light Company. Installation is typical for supplying small communities and rural loads. Rating is 67000Δ–13090Y/7560 volts with single-phase automatic LTC regulation in 32 steps covering a range of 20%.

PENNSYLVANIA TRANSFORMERS

## Everything's Up-to-Date...

In Kansas City, the vast redevelopment program that's rapidly changing the face of the city has a special meaning for its railroads and electric utilities. Satisfying today's requirements while readying for tomorrow's increased needs takes precision planning in these key industries.

Kansas City has come a long way since its cow town days, but cattle is still King. Holding up the throne have been dependable railroad transportation and power. And in *railroading* and *electric utilities*—as in all industry—Kerite Cable has been a standard of dependability for many years. ***Likewise, when tomorrow's problems occur—Kerite will already be ahead of them.***

**KERITE CABLE**

*it's the* **KERITE** *that makes the difference*

***General Office—30 Church Street, New York 7, N. Y.***

**SALES OFFICES:**
Albuquerque, Ardmore, Pa., Birmingham, Boston, Chicago, Cleveland, Denver, Glendale, Cal., Houston, Lake Wales, Fla., Portland, Ore., St. Louis, Salt Lake City, San Francisco, Seattle

# Editorial Comment

APRIL 4, 1960

## Puerto Rico Sets an Example

In a pioneering program that sets a tough example for state-side utilities to top in ingenuity and resourcefulness, a handful of engineers of the Puerto Rico Water Resources Board has turned to airborne line construction techniques to knock weeks and thousands of dollars off construction budgets.

For what appears to be the first time Puerto Rican crews are building a 115-kv line, on a production basis, almost completely by helicopter. Crews and materials are spotted, poles set, and transmission conductor literally pulled-in by helicopter at rates up to 25,000 ft per day over hilly terrain and across cultivated fields unmarked by construction roads.

Instead of using their helicopter as a merely auxiliary tool, the Puerto Rican engineers have built their day-to-day job planning around it. They tailored their entire operation to skillfully timed short-haul flights from strategically spotted staging areas. And it has paid off. In less than a year the cost of the helicopter has been matched in savings.

The kind of "Yankee" ingenuity being displayed by Puerto Rican utility men is playing a big part in keeping pace with the economic expansion, as this island of 2½ million moves from an agricultural to an industrial economy. In the last ten years Puerto Rico has had an accelerated economic growth. New industries have sprung up and more appear each month—petroleum, metals, chemicals, textiles and a host of others. Use of electric energy is growing at more than twice the average rate here in the U.S.; 20% in 1957 and 1958.

Puerto Ricans may well be proud of their achievements as they show the way to a higher standard of living.

## How Should We Express Our Big Numbers?

*A guest editorial by Theodore Baumeister, Consulting Engineer; Stevens Professor of Mechanical Engineering, Columbia University, New York, N. Y.*

The units we use for measuring the capacity and output of electrical power plants are becoming increasingly confusing. Sometimes we use kilowatts; sometimes megawatts. Then, when we write about energy, we use kilowatt hours, or billions of kilowatt hours, or millions of megawatt hours, or megawatt days per ton. This is confusion compounded.

It probably stems from the fact that the watt and watthour were quite adequate years ago, in the historical past, when power systems were smaller. But the watt in our expanding power industry today has become so small that to use it is like measuring the depth of the Grand Canyon in inches. First we substituted kilowatts for watts, then megawatts for kilowatts. Now even megawatts have grown so small that we flounder around with further substitutes. We could say, following the vaunted metric rule book, that the electrical energy output of the nation last year was about 700,000,000,000,000 **watt hours**

700,000,000,000 **kilowatt hours**

700,000,000 **megawatt hours**

700,000 **gigawatt hours**

700 **terawatt hours**

(See Mark's "Mechanical Engineers' Handbook," Sixth Edition, pages 1-72)

But why not simplify the whole thing? Avoid even the confusion of defining a billion as a thousand million in the U.S. or a million million in the U.K. It makes more sense to take a leaf from the scientific notebooks and use a vocabulary which agrees to measure electric energy, as in most power tariffs, in kilowatt hours. Then use the exponential function of ten so that, in the example above, electric output last year would be simply written as: $7 \times 10^{11}$ or $700 \times 10^{9}$ kilowatt hours. This would provide solid technology, realistic mensuration, and universal understandability.

# AE, Westinghouse to Build 750-Kv Test Line in W. Va.

**Five other manufacturers are also participating in the Apple Grove, W. Va., project. Tests to start late this year**

American Electric Power Service Corp and Westinghouse Electric Corp jointly announced last week a project to build and operate a 750-kv test transmission line at Apple Grove, W. Va.

Objective of the joint project is to gather information and experience which will be helpful in determining the technical and economic feasibilities of transmitting large blocks of power at voltages up to 750 kv.

The new EHV project, made up of three ½-mile lines, will provide a continuation of similar investigations carried out by the two companies when they built and operated the 500-kv Tidd test line at Brilliant, Ohio, in 1946 (EW, Dec. 29, 1945, p 6 and Dec. 14, 1946, p 4).

"The Apple Grove project is the logical extension of the extra-high-voltage test program carried out by American Electric Power and Westinghouse, with the cooperation and assistance of other manufacturers, beginning in 1946," said A. C. Monteith, vice president and general manager of Westinghouse apparatus products group. The objective of that earlier study, continued Monteith, was "to develop the experience and equipment needed to transmit larger and larger blocks of power economically."

Philip Sporn, president of American Electric Power, added that as a result of the experience gathered on the Tidd test line, the AEP was able to build and operate economical 345-kv lines. "We are hopeful that this new study will push forward the frontiers, both economic and technical, of transmission voltages at higher levels up to 750 kv," he said.

Other firms participating in the new project are: Kaiser Aluminum & Chemical Corp; Lapp Insulator Co, Inc; Ohio Brass Co; Thomas & Betts Co, Inc; and American Bridge Division of U.S. Steel Corp.

SPORN

MONTEITH

The nature and extent of their participation is indicated in the box to the left.

Work on the project will begin immediately. The first tests are scheduled for late 1960 or early 1961. They will continue for three to five years.

Based on experience gained on the Tidd test project, several testing innovations will be incorporated in the Apple Grove line.

Three test lines will be built, each using a different conductor configuration. The lines will be energized simultaneously to measure radio-influence and corona losses. This permits a comparison of test results under identical atmospheric conditions. In addition, all conductors on all three lines will carry heating currents continuously to simulate actual operating conditions.

Results of the tests will be processed through automatic data-logging computers and recorders.

Apple Grove is on Appalachian Power Co's lines about 25 miles north of Huntington, W. Va.

### Other Firms Participating in 750-Kv Research Line

**KAISER ALUMINUM & CHEMICAL CORP** will supply all transmission cable. The cable will be ACSR, and will range in diameter from 0.576 in. to 1.6 in. The project will require about 130,000 ft of aluminum cable.

**LAPP INSULATOR CO** will develop clamps, fitting and grading devices for the transmission line and bus structure. After the R&D work is completed, Lapp will make suspension insulators and hardware for the line.

**OHIO BRASS CO** is also supplying, with Lapp, the insulators and hardware. The firm also participated in the 1946 Tidd 500-kv AEP project.

**THOMAS & BETTS CO** will supply all connectors for the Apple Grove project. The connectors will be specially designed to "perform as well or better than the cable at 750 kv."

**AMERICAN BRIDGE DIVISION** of U. S. Steel Corp will design and build six single-circuit towers for the test line. It will also furnish six dead-end structures and substation.

# June Dates for Meetings Abroad

U.S. electrical industry people planning to attend this year's World Power Conference in Madrid, Spain, June 5-9, will also find it convenient to go to the International Conference on Large Electric High-Tension System (CIGRE) in Paris, June 15-25.

Using the theme, "Methods of Solving Power Shortage Problems," the Madrid conference will stress the long-term supply of a country's energy needs. It will treat the subject by considering some of its aspects. Examples:

- What methods can be used in investigating a country's energy sources and requirements?
- The implications of efficiency and utilization in energy production.
- What are some of the new developments in the transportation of fuels and the transmission of electrical energy?

The CIGRE conference a week later will have 130 technical papers eight of which will be by American electrical engineers. The CIGRE meeting, known by the initials of its French name—Conference Internationale des Grands Reseaux Electriques—will have papers presented in four general groups: (1) Generation, transmission and circuit interruption; (2) Construction, insulation and maintenance of overhead and underground lines; (3) Operation, protection and interconnection of power systems; and (4) Transmission at voltages above 220 kv.

**Registration a Must**

Officials of both conferences emphasize that all delegates and participants to either the World Power Conference or the CIGRE meeting must register through their respective national committees.

For the World Power Conference, participants should write to the U.S. National Committee for registration forms, which must be completed and returned to the Secretary with a $50 registration fee. Correspondence should be addressed to the U.S. National Committee, World Power Conference, Engineer's Joint Council, 29 West 39th Street, New York 18, N.Y.

The same procedure and fee are required also for the CIGRE meeting. The address in this case is U.S. National Committee-CIGRE, 2 Broadway, New York 8, N.Y. In the case of non-members, the CIGRE registration fee is $62.

# Convicted on Priest Rapids Perjury

Frank T. Bell, former consultant to the Grant County PUD, was found guilty of perjury in a judgment handed down March 25 by Superior Court Judge Frank D. James.

A close friend of Glenn T. Smothers, former manager of the PUD, Bell had been accused of giving false testimony to a grand jury investigating affairs of the PUD, particularly in relation to the construction of Priest Rapids Dam. He received funds from the Shoup Voting Machine Co and the McLean Engineering Co, linked in the evidence with Merritt-Chapman & Scott, holder of the dam contract. Some of these funds he shared with Smothers.

Bell said he received money from Shoup as commissions for voting machines he helped to sell and from McLean for consulting work on power and irrigation projects in California, Oregon and Washington. Lewis M. Schott, president of the voting machine company and also connected with the McLean firm, denied that he had hired Bell for McLean. Shoup funds paid to Bell were for public relations work and not for commissions on voting machine sales, he testified, in contradiction to Bell's statements.

Bell testified he had paid $3,250 to Smothers for Smothers' help in landing a voting machine contract, but testimony revealed Bell had made the payment to Smothers a month before he received the check from Shoup.

Bell faces a maximum penalty of 15 years on each of five counts.

# Rocking the Boat For Water Flow

Pacific Gas & Electric Co's Sacramento Division is operating an unusual set of ice breaking vessels in the Sierra Nevadas. When the temperature dropped to 10F recently, this fleet was called in to break the ice and keep the water flowing to customers and to two company powerhouses, served by the El Dorado Irrigation District. For more than a week specially designed outboard motor boats were used to keep the 22-mile El Dorado Canal open and assure a flow of 160,000 gallons per hour to the PG&E customers.

More than 50 men were called in to break the ice. While his partner steers, this icebreaker, steadying himself by a rope, jumps up and down to crack the ice.

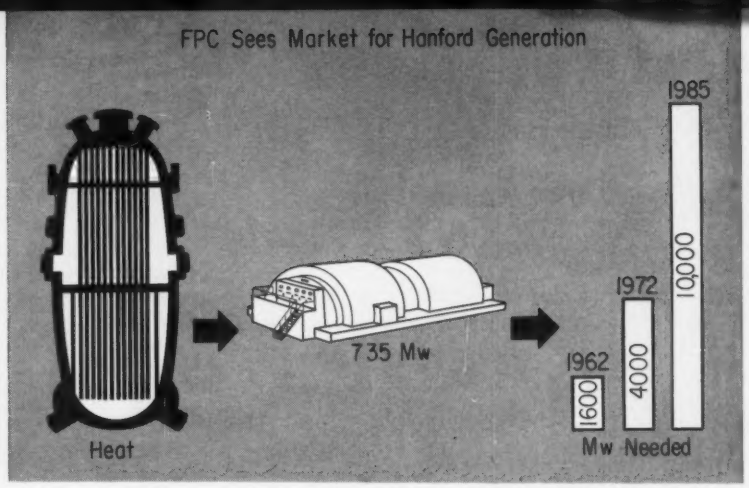
## Memphis Planning Plant Near Loosahatchie River

A site will be purchased this year by Memphis Light, Gas & Water Division for a steam electric generating station. The location is expected to be near the Loosahatchie River, not far from the Mississippi.

Size of the plant has not been revealed, nor has the construction date been announced.

Memphis LG&W conferred recently with TVA on the possibility of buying power rather than adding another unit to its Allen plant.

# Generation At Hanford: FPC Study Says It's OK




The Federal Power Commission has just completed a study at the request of the Atomic Energy Commission which could serve as the basic blueprint for bringing hundreds of thousands of nuclear kilowatts to the Northwest.

The study treated the economic attractiveness of adding steam production equipment and turbine generators to a $145-million plutonium production reactor already authorized by Congress in August, 1958, and presently under construction at Hanford, Wash. The reactor is being designed by General Electric Co and a construction contract has been awarded by AEC to Kaiser Engineers. A heat dissipation system, to "dump" reactor heat into the Columbia River if power generation equipment is not authorized by Congress is being designed by Burns & Roe.

The FPC study, however, says it would be economically sound—subject to some appreciable contingencies—to turn the reactor's heat to production of electricity. FPC claims that nuclear power will be no more costly than fossil fuel or hydro power if forecast costs of uranium fuel elements do, indeed, come down and prices of plutonium to be produced in the reactor remain stable at the present $12 per gram.

### FPC Settles on 636 Mw

After considering a wide range of possible reactor designs, a 636 Mw dual-purpose power generating and plutonium production complex was concluded to be economically feasible by FPC when compared with fossil fuel and hydroelectric power costs on the basis of decreasing uranium fuel prices in the future.

On the other hand, the FPC report stresses equally that not one out of 24 reactors considered would be economically feasible for power operations evaluated on present uranium prices.

Bonneville Power Administration assisted FPC with the study. Bonneville engineers computed costs of fossil fuel power output delivered to BPA's 230-kv transmission system at the reactor site will be $12.69 per kw over the reactor's dual-purpose period, 1964-72. Costs of hydro power during the same period of time, as estimated at BPA, varied from $7.53 per kw at 2.5% federal interest rates to $9.28 per kw at 4%. And in both cases, it was concluded that power coming from the production reactor would have a value equivalent to the cost of power delivered by conventional fuel and hydro plants located at the same site.

### Market Study Shows Need

The FPC study, which was requested by AEC last May, also took a hard look at the long range power needs in the area.

By 1972, it was found that 4,000 Mw additional thermal capacity would be required, and that by 1985 extra capacity requirements will increase by 10,000 Mw. Beginning with NPR plant operation in 1962, the study predicted that 1,600 Mw would be required.

The very substantial investment being made in NPR prompted the AEC to ask FPC to undertake the study in the first place. Since large amounts of heat is the by-product of plutonium production reactors, basic objectives of FPC's study were to determine the feasibility of adding necessary generating equipment to NPR to produce electrical power.

Stone & Webster Engineering Corp made a similar study in 1958 which concluded that, in general, it was more sensible to dump NPR's heat into the Columbia than turn it into electrical power.

The convertible reactor plant is estimated to cost $25 million more than a single-purpose (plutonium producing only) plant of comparable plutonium production capacity.

### Cost Is $158 per Kw

Expressed in unit capacity costs, the ultimate capital investment estimated for the 636 Mw plant is $158 per kw over the 1964-72 dual purpose period of the reactor-when plutonium production would absorb reactor operating and fuel costs charges. During the reactor's remaining period of life, or 25 year power-only period beginning in 1972, the capital investment is $142 per kw. For the power-only period, 1972-1997, the reactor would attain a 735 Mw electrical power level. The reactor is scheduled for completion on Oct. 1, 1962, and the 1964 date would afford two years of necessary operating experience before start-up of power facilities.

Conversion to dual-purpose operations would consist of addition of from two to four of the largest size turbine generators practicable under the steam conditions, about 200-250 Mw, and auxiliaries.

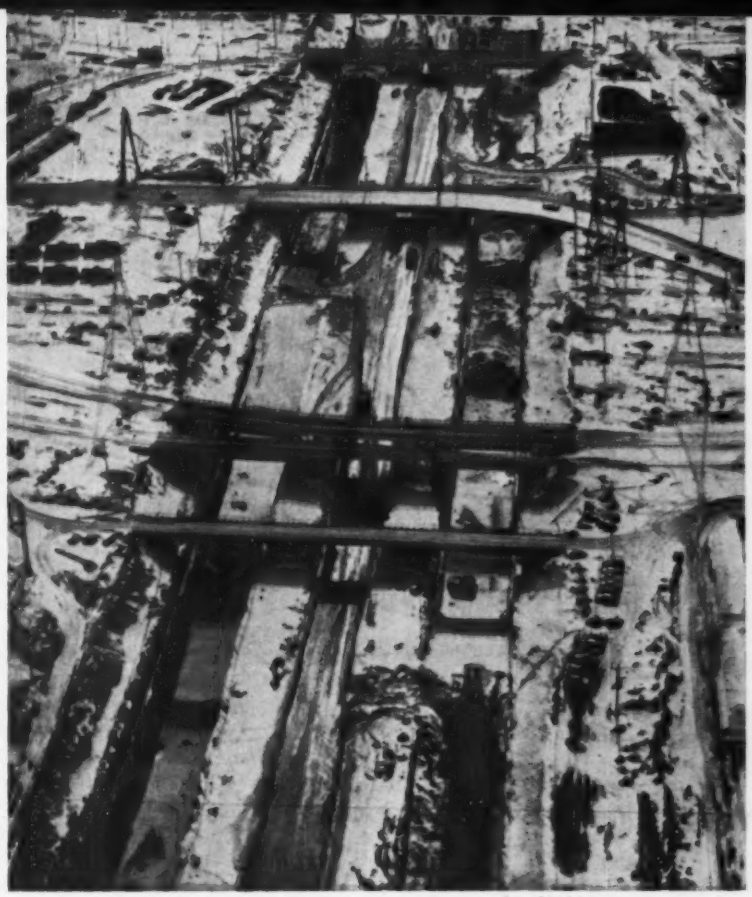
Major elements of difference which make up the $25-million additional estimated cost of the reactor consists of neutron non-absorptive zirconium process tubing and piping and pumps for use at high temperatures and pressures.

## Judge Orders New Pleas In Price-Fixing Suit

After turning down the *nolo contendere* pleas of ten electrical equipment manufacturers accused of conspiring to fix prices, Federal Judge J. Cullen Ganey ordered a new arraignment in U.S. District Court in Philadelphia for April 8.

On Mar. 24 Judge Cullen Ganey had turned down the *nolo contendere* pleas and ordered them to enter guilty or not guilty pleas within five days. The time was extended to 15 days at the request of defending attorneys.

Defendant companies are Allis-Chalmers Mfg Co; Federal Pacific Electric Co; Ohio Brass Co; H. K. Porter Co; Lapp Insulator Co; Porcelain Insulator Corp; A. B. Chance Co; I-T-E Circuit Breaker Co; Joslyn Manufacturing & Supply Co, and Hubbard & Co. Individual employees of three of the companies are also named in the action.



## Niagara Power Project Taking Shape

These twin canals and conduits will carry water from the Niagara River intake to the gigantic generating station of the Niagara Power Project. More than a mile of conduit structures have been completed in sections 1 and 2 of the project.

Well over half a million cubic yards of fill have been placed over the completed conduit sections at this point in construction. Section 1 is 36.4% complete; section 2, 31.7%, and section 3, 19.1% complete.

## Burns Creek Hearings End; Late April Vote Possible

Hearings on the controversial Burns Creek hydro power project on the Snake River, Idaho, have been completed by the House Interior Subcommittee on Irrigation and Reclamation. The subcommittee could vote on the project during late April—possibly the 27th or 28th.

Final hearings (March 24-25) were held to re-question witnesses from the Interior Department on the need and economic feasibility of Burns Creek. N. B. Bennett, assistant reclamation commissioner, defended the $50-million project as worthwhile in the face of withering attacks by Reps John Saylor (R-Pa.) and James Haley (D-Fla.).

Saylor insisted that Burns Creek isn't economically feasible as a power project, although a simple river re-regulating reservoir could be built at the Burns Creek site to aid the upstream federal Palisades project. He pointed to the "enviable record" of the Bureau of Reclamation of "never having built a project within its estimated cost." Haley added that, "when reclamation comes up here (to Capitol Hill) with a project, you can just figure that it's going to cost about two to three times as much in the long run."

Rep Wayne Aspinall (D-Colo.) lamented that Burns Creek wasn't authorized and built at the same time as Palisades, since the two form an integral project.

Interior Department witnesses were left over from the subcommittee's February hearings (EW, Feb. 29, p 68). The subcommittee will hold its next two days of hearings April 11 and 12 on another matter, but expects to return to Burns Creek at the end of the month. This will be after the hearings have been printed and distributed.

## Partnership Offered On Rio Grande Project

A House foreign affairs subcommittee has completed hearings on Amistad dam (across Rio Grande River 12 miles up stream from Del Rio, Texas) and probably will vote on the project within a month.

Central Power & Light President J. L. Bates told the subcommittee, in final hearings, that his company would be willing to pay the federal government $337,000 yearly for rights to generate power from the dam's falling water. Amistad would not produce firm power, according to the Federal Power Commission.

# Considers Simplified 100-Mw

## Long Island Lighting to add economic steam capacity at Barrett Station for operation in later part of 1962

**WILLIAM WELCH JR**, Vice President, Engineering, Purchasing & Stores, Long Island Lighting Co, Hicksville, N. Y.

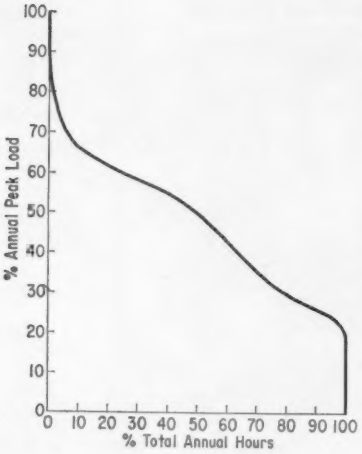



**FIG 1—ANNUAL DURATION CURVE** shows Christmas load effect on system

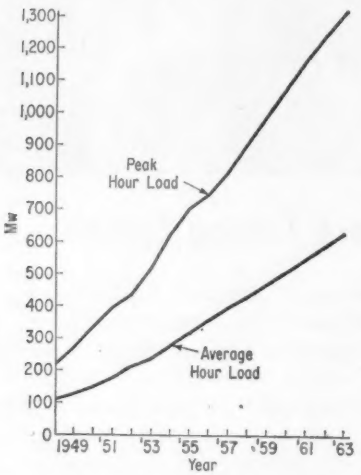



**FIG 2—AVERAGE HOUR** and peak hour plot shows peak doubles annually

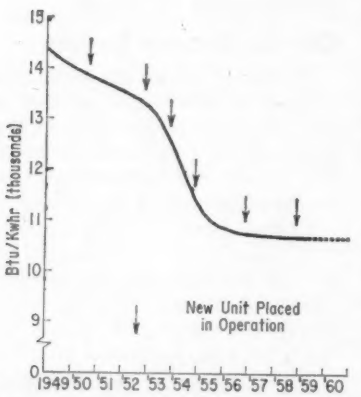



**FIG 3—SYSTEM HEAT RATE** declines as more efficient units are installed

A 100-Mw generating unit, providing low-capital-cost capability for sharp peak loads, is planned for operation in late 1962 at Long Island Lighting Co's Edward F. Barrett Power Station. For peak-load service, capacity at lowest first cost is of prime importance. The usual philosophy governing plant design, in contrast, stresses fuel economy. But the concept adopted fits LILCO system development.

The system's load has a high proportion of residential component, roughly half. Commercial load constitutes a quarter; industrial load, less, and the latter is the light type with little round-the-clock demand. The high residential ratio and the additive effect of commercial and industrial loads combine to give daily load cycles with acute peaks and valleys. Seasonal variations, culminating in pre-Christmas peaks, are superimposed on daily cycles. The estimated Christmas load amounts to as much as 100 Mw.

Thus, in a typical load-duration curve, the top 20% of load is on the system only 140 hr a year. A plot of average hourly and peak-hour loads for each year since 1948 through 1959, extended as trends for the next few years, shows that each year's peak more than doubles the average load, the divergence between them increasing. Although higher summer loads, influenced by air conditioning, are developing, the ratio of winter to summer peak has not changed appreciably. Summer peaks are expected to remain lower than winter ones.

The rapid demand growth is apparent in a plot of average hourly and peak-hour loads for years since 1948. In the latter year the maximum hourly demand was about 225 Mw. By 1959 the maximum hour had approached 1,000 Mw, an increase of about 325% in 11 years. This increase averages about 70 Mw a year and, allowance being made for necessary reserves, means that about 80 Mw in newly installed capacity was needed yearly.

To meet its ever-growing load, the company installed the first 50-Mw Port Jefferson unit in 1948 and the second in 1950. It put in the first Glenwood 115-Mw unit in 1952, the second at Far Rockaway in 1953, and the third at Glenwood in 1954. In 1956, it increased the size of the units and went on a two-year cycle by installing the first of a series of 185-Mw units at Barrett, then a second, Unit 3, at Port Jefferson in 1958, and the third, Unit 4, which will go into service at Port Jefferson this year. A fourth 185-Mw unit, Barrett Unit 2, is projected for 1962 operation.

### Used Old Capacity

Port Jefferson Units 1 and 2 were designed for simple-cycle, 1,250-psig, 950F steam conditions; the three 115-Mw units for reheat cycle, 1,450-psig, 1,000/1,000F steam conditions; and, the 185-Mw units for reheat cycle, 1,800-psig, 1,000/1,000F.

LILCO faced for many years the problem of providing generation for peak loads. The company solved it by using older, less efficient units. But the company realized that eventually it would run out of old capacity for carrying peak loads. Yet the economic advantages offered by the large increases in efficiency available then proved that standard equipment was the most economic.

LILCO's review of its plans revealed that changed basic conditions warranted reconsideration of the timing of the fourth 185-Mw reheat unit at Barrett for 1962 operation. The steam-plant heat rate, declining since 1948 as more efficient units increased, leveled off in 1956. The growing preponderance of higher-efficiency units decreased load factor on those very units, requiring longer operation at light loads. LILCO was well into the area of diminishing returns. Another factor of considerable concern was continued monetary inflation at the yearly rate of about 4%. Overall

# Generating Unit for Peaking

power station costs had increased more than 25% in a six-year period. Conversely, the price of fuel (coal and oil) has reversed the upward trend and now is at the same level as ten years ago.

As the maximum-hour more than doubled the average-hour load, the difference continually widening, the company saw no prospect of easing the peak-hour burden. But, by adding to the 20% peaking demand the normal allowance for reserve, LILCO discovered that the low-use-factor component was about a third of installed capacity.

### 72% Would Be Reheat

The proportion of installed reheat equipment has grown to where additions in the customary pattern would relegate high-efficiency reheat equipment to peaking service solely. When the latest reheat unit would operate at Port Jefferson at the year's end, 72% of total system capacity will be high-efficiency reheat equipment. The remaining 28%, including Port Jefferson Units 1 and 2, is the lower-efficiency peaking capacity.

### Peaking Units Studied

Were the next plant addition a large reheat unit, total capacity of reheat units would be increased to where it would be necessary, in effect, to operate one 115-Mw reheat unit in the short-duration peaking service. On the other hand, 100 Mw of peaking capacity would improve appreciably the effective operating period of the 115-Mw reheat unit. Thus, a conventional reheat installation would cost about 25% more than Barrett Unit 1 and, in effect, would relegate a 1952-54 reheat machine to peak-hour operation. Nor would the conventional installation bring appreciable heat-rate improvement. Studies show further that it is uneconomic for the LILCO system to advance beyond the present steam conditions of 7,800 psig and 1,000/1,000F.

As continuing the installation of conventional reheat capacity was undesirable, LILCO scrutinized the concept of installing capacity specifically for peak-load generation. Other utilities, dealing with similar problems, had advanced several solutions, such as:

**1.** Pumped storage hydro power for peak loading by hydro and steam systems where conditions were favorable. Such was not LILCO's case.

**2.** Automatic diesel units for peaking service. Because of the small unit size, 2,000 kw, and the noise problem, the favored location for this type is the end of long transmission lines, where the unattended automatic features should prove especially desirable.

**3.** The gas turbine whose operating experience pertained to intermittent high unit load requirements for peaking.

**4.** A so-called "spinning-reserve

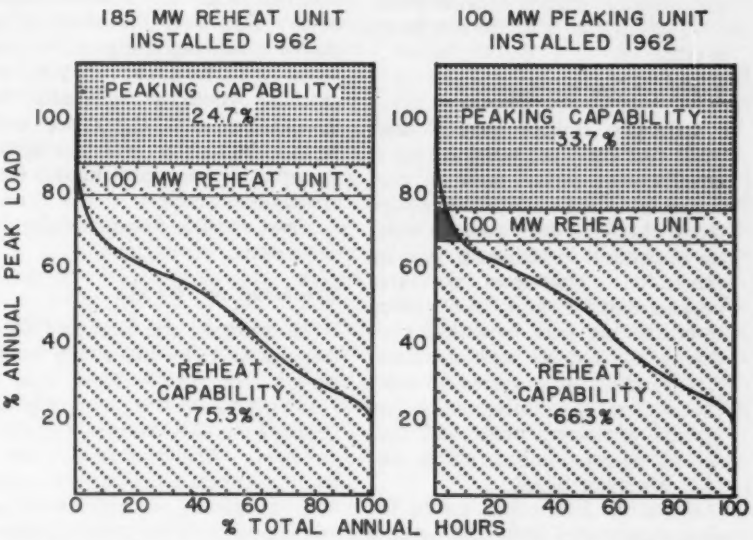



FIG 4—USE of last 115-Mw (1954) reheat unit is indicated on basis of annual load requirements in 1962. It would be relegated to brief peaking service

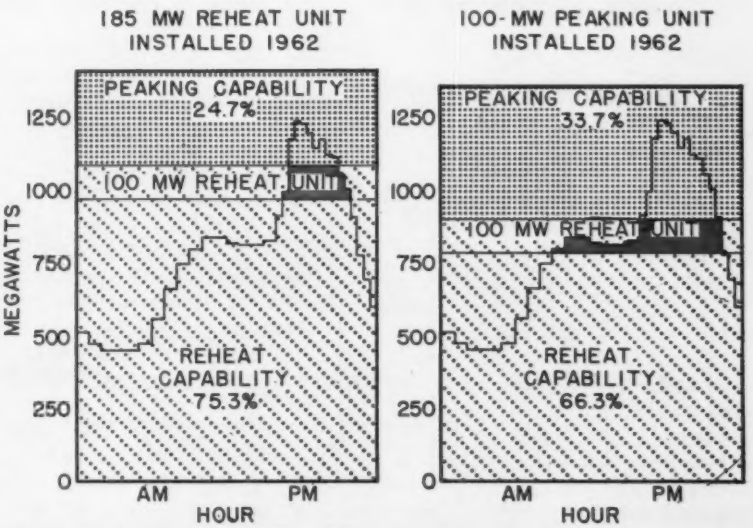



FIG 5—PEAK LOAD DAY in 1962 would compel conventional reheat installation to go to peaking service without appreciably improving the system heat rate

capacity" unit, essentially a boiler turbine with built-in high overcapacity usable for peaking service. The capacity has not been developed enough for LILCO's 1962 load requirements.

**5.** The concept most suitable to LILCO's system was a greatly simplified oil-fired steam turbine generator plant. Elimination of all but the essentials would give a unit for generating required power when needed. This plant would have minimum first cost rather than low operating or fuel cost, fuel cost being almost negligible because peak-load generation is for so few hours a year.

### Per Kw Costs Similar

LILCO's studies showed that, while fuel costs are weighted about equally with capital costs in economic selections of base-load equipment, they are only about a tenth as important in choosing peaking generation. The most economic peaking unit for the LILCO system would be the least expensive consistent with reliable, safe operation. Cost studies were prepared for automatic diesel generating units, gas turbine generating units, and simplified oil-fired boiler, steam turbine generator plant.

Costs in dollars per kw of installed capability proved to be very similar for all three. But the studies led to LILCO's determination to proceed with the simplified steam cycle plant.

Obviously, a peaking unit would be a real benefit if the planned 185-Mw unit at Barrett could be deferred a year or longer. Load growth characteristics indicated the need for capacity additions, with due allowance for reserve requirements of about 90 Mw per year. The nearest commercial-size turbine generator with some allowance for greater-than-expected load increase would be about 100 Mw. Manufacturers had in operation many machines of this size classification.

Similarly, LILCO found that boiler manufacturers had ample experience with the equivalent-size boiler. But, were the company to choose a peaking unit good for two years' growth, a 185 to 200-Mw machine would be indicated. In this range, solid experience with boilers and turbines was lacking for the pressures and temperatures economically suitable.

New untried designs might be necessary.

### Size Fixed at 100 Mw

Accordingly, the company fixed the size at 100 Mw, which would provide for slightly more than a year's normal growth, permitting deferral of the 185-Mw reheat unit for one year. The intermittent labor requirements of a peaking unit make it preferable as an addition to an existing plant. The system had three possible sites — Far Rockaway, Glenwood, and Barrett. The addition of Port Jefferson Unit 4 left no room there.

Far Rockaway appeared a likely place, except that the high cost of transmission for moving the power into the system would have to be met. The cost of transmission, along with the desirability of reserving the area for extension of the existing propane facilities, ruled out a site on the Glenwood gas plant.

Barrett proved most desirable. Existing transmission could absorb 100 Mw, and one or two peaking units could be installed west of Unit 1 without interfering with the five or more conventional units planned for an eastern extension. Suitable heavy fuel oil facilities will be required.

### These Specified

As a steam power plant for peaking service only is unique, LILCO specified these operating conditions in the plant and equipment designs and guarantees:

**1.** Average annual operating time of 250 hr, from 1,000 to 50 hr per year.

**2.** Average of 50 startups per year, maximum start-up time being approximately 4 hr from cold start to full load.

**3.** Daily loading of any or a combination of 0 to 4 hr at full peak load; 0 to 24 hr at part loads; and, 0 to 4 hr at no load.

**4.** Two experienced personnel for plant operation, including daily startup and shutdown.

**5.** Operation largely during winter months, with possibility of some summer operation during maintenance of other generating equipment.

**6.** Shutdown periods of short duration, 16 to 48 hr, and medium duration, several days to several weeks.

**7.** Short and long lay-up periods of two to six weeks, and six weeks to ten months, respectively.

**8.** Maintenance overhauls according to this scheduling: Major, once every ten years; minor, once every five years.

**9.** Routine minor maintenance during shutdown and overhaul.

**10.** Routine inspection during minor lay-up, not more than once a month.

**11.** All components capable of operation, if required, in a normal base-load type of operation without undue stress or maintenance for extended periods. (Plant design must contemplate such operation because

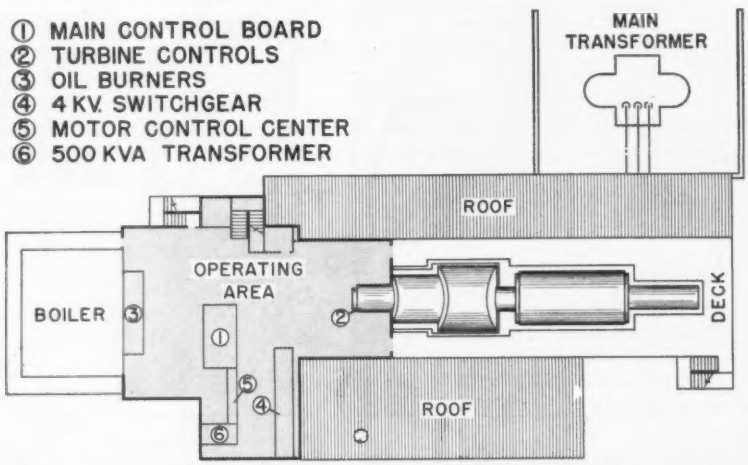



**FIG 6—ARRANGEMENT** of 100-Mw peaking unit reduces turbine deck and has turbine close to boiler, enclosure containing turbine standard and the oil burners

of possible extensive outages of other units on LILCO's own or interconnected systems.)

**12.** Because of extended lay-up periods, special provisions for preventing corrosion or other damage.

**13.** Provision for reduction in start-up and stopping losses.

Selection of the most economical steam electric plant centered on evaluation of the most economical steam cycle. Early investigations showed that the minimum-cost cycle would be non-reheat with throttle steam conditions of 1,250 psig, 950F, or 850 psig, 900F. Detailed comparison showed that 850 psig, 900F would be preferable for the 1962 peaking unit. Its estimated installed cost was $2 per kw lower than the other cycle's.

More savings of about $5 per kw were obtainable in the steam cycle by reducing heat-recovery equipment to a single feedwater heater for 250F feedwater and deleting the regenerative air heater. The resultant heat rate is expected to be about 14,000 Btu per kwhr.

### Gave Cost Reduction

A major cost reduction came through limiting fuel-burning facilities to those for heavy oil. Elimination of coal conveyors, bunkers, pulverizers, hot-air ducts, coal piping and burners, associated supporting steel and foundations, and ash and dust-handling and disposal equipment, cut the overall cost $20 to $30 per kw.

A further cost reduction might have been practicable through burning natural gas. But, as peak loads on the gas system coincide with those on the electric system, gas would not always be available for the boiler. Heavy oil was the next lower-cost fuel and the most flexible for intermittent peak-load demands. Other reductions came through compact plant layout, less plant equipment, and the designing of individual plant components.

The space requirements of peaking unit have been reduced to much less than half that of the Barrett 185-Mw reheat Unit 1. The location has been arranged for shortest interconnecting services between the units and for use of the traveling gantry crane by extending its rails. The measures gave room for a second peaking unit within the crane rails.

Enclosures will be minimized for the outdoor design in accordance with LILCO practice for a decade. The siding will be lightweight corrugated aluminum with minimum windows and doors. The steel stack at the boiler outlet will be on top of the boiler where advantage can be taken of its supporting steel.

The turbine deck is the minimum provided by the turbine pedestal. Lay-down area for maintenance will be on the Unit 1 turbine deck or the paved area between units. The turbine is as close as possible to the boiler, an enclosure encompassing the turbine standard at one end and the oil burners at the other. This control operating area contains the main control board, the recorder and relay board, 4-kv switchgear, 480-v motor control center, and 480-v, 500-kva transformer. The unit can be cold started, operated, and shut down by two operators.

The minimum-cost peaking steam turbine has been sized to use all available capacity of the last-stage blading up to the limit for a given turbine frame size, which may be considerably higher for peaking than for conventional turbines. The generator's cost can be reduced also, provided system transmission and distribution characteristics are favorable. The peaking generator power factor has been boosted from 0.85 to 0.95; the short-circuit ratio reduced from 0.64 to 0.50. These changes yield a smaller frame size.

### Effects Greater Cooling

A third reduction may come through raising the output of a reduced-size generator by bringing cooler hydrogen to its windings. The greater cooling effect of colder winter cooling water can be used to advantage in standard-size hydrogen coolers, the reduced summer output being tolerable on a system whose summer demand is the lesser.

Condenser sizing is based on minimum cost consistent with the needs of maximum turbine output in winter. Heat balances indicate that maximum turbine output is obtained at about 3 to 3½ in. Hg backpressure. On the basis of 50F winter circulating water, a cleanliness factor of 0.90, and a tube velocity of 7½ fps, a minimum condenser of about 25,000-sq-ft surface will be installed. During summer operation with 85F circulating water, backpressure will be 6 to 6½ in. Hg. The plant output of 4 to 5 Mw is acceptable.

Other major cost-reduction areas in the boiler are the pressurized furnace-single forced-draft fan and the elimination of induced-draft fans and of dust collector or precipitator.

On the basis that reliability will be equivalent to that of a 185-Mw unit with dual auxiliaries, all peak-unit pumps—the boiler feed, condensate and circulating-water pumps—are single, full-capacity units. Nowhere is there a margin of excess capacity beyond that for meeting winter maximum turbine output. Elimination of by-passes around the feedwater heater and control valves also saved.

### Auxiliary Cut Out

The major electrical cost reduction was elimination of a new auxiliary transformer. Instead, connection will be made to the Unit 1 4-kv starting transformer, and the full gross output of the peaking turbine generator will be delivered to the system network. This arrangement is feasible for auxiliary power requirements of only 3% of a gross plant output approaching 103 Mw. Miscellaneous additional savings in electrical equipment pertain to the fused, magnetic, across-the-line starters for the 4-kv switchgear, instead of the substation-type air circuit breakers, and single controls for all motors from the switchgear or the 480-v motor control center.

Costs given include company charges and overheads. They should not be compared with those for other units elsewhere. LILCO has estimated that a conventional 185-Mw reheat unit at Barrett for 1962 operation would cost $173 per kw of net capability, exclusive of step-up transmission and substation facilities. A similar unit, but of 115-Mw capability, would cost $191 per kw for the same plant equipment. Based on close estimating prices furnished by manufacturers, the per-kw cost of the 100-Mw simplified steam cycle unit will be about 60% of that of the conventional reheat 185 Mw unit. The approximate net savings expected from deferment of a 185-Mw conventional reheat unit total well over $3,000,000.

Electric Utility Methods
CONSTRUCTION • OPERATION • MAINTENANCE

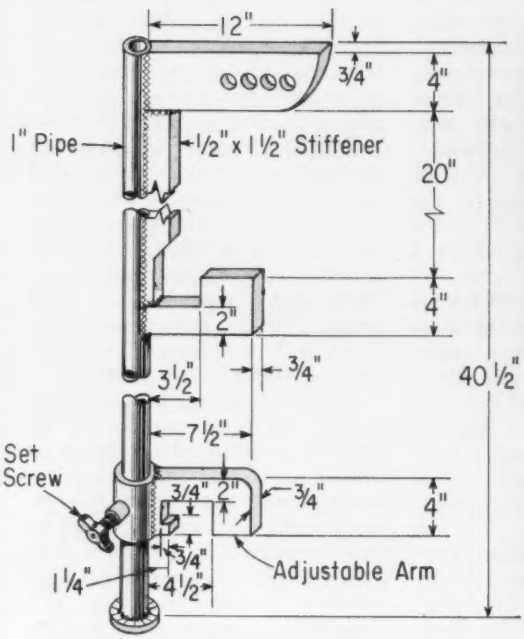
# Lifting Device Speeds Ash Pump Repair

**FAYE BLITON,** Maintenance Man,
**JOHN C. LEMM,** Maintenance Foreman, Clifty Creek Plant, Indiana-Kentucky Electric Corp, Madison, Ind.

A simple lifting device built at Clifty Creek Plant helps in removing and installing impellers on ash pumps. By making it safer and easier to align the 685-lb impeller with the open end of the pump housing and drive shaft, this device saves an average of 5 man-hr per pump rebuild.

Formerly it took considerable pulling and tugging, plus use of chain falls with slings and pinch bars, to withdraw or position the impeller through the pump housing. It was difficult to obtain the required alignment with the threaded end of the pump drive shaft so that the shaft could be screwed into the impeller hub.

The lifting device makes it easy to obtain the correct alignment. It suspends the impeller from a point directly above its center of gravity and therefore holds it in a vertical position. The clamping action of the device firmly holds the impeller while it is being loosened or tightened. With the impeller suspended from a hoist or chain falls, it can be lifted out easily and lowered to the floor or returned to place without trouble.



The top hanger, bracket and adjustable shoe of the device were made of ¾-in. steel plate. The upper two parts were welded to a 1-in. pipe; the lower shoe clamps to the pipe with a thumb screw. A ½x1½-in. flat bar stiffner was stitch-welded to the pipe to prevent bending under load. Construction of the device from scrap materials took about 8 man-hr.

At Clifty Creek, 20 pumps need rebuilding about once a year. It used to take three men about two hours to install the impeller on the shaft. Now it takes two men less than 10 min. The device saves at least 120-man-hr per year in assembling and disassembling these pumps.

# Tester Shows Value of Good Connections

**ROBERT L. WARE,** System Manager, Transmission and Distribution, Virginia Electric & Power Co, Richmond, Virginia

To teach foremen, linemen and servicemen the importance of conductor cleaning, use of inhibitor, tool adjustment and proper selection of dies, Virginia Electric & Power Co engineers designed and built their own testers. These devices help demonstrate the difference in operating temperature between good and poor connections.

The testers are made from old 500:5 CT's, which are energized on the secondary side at 120 v through a variable voltage source. Conductor loops with good and poor compression connections are on the primary side.

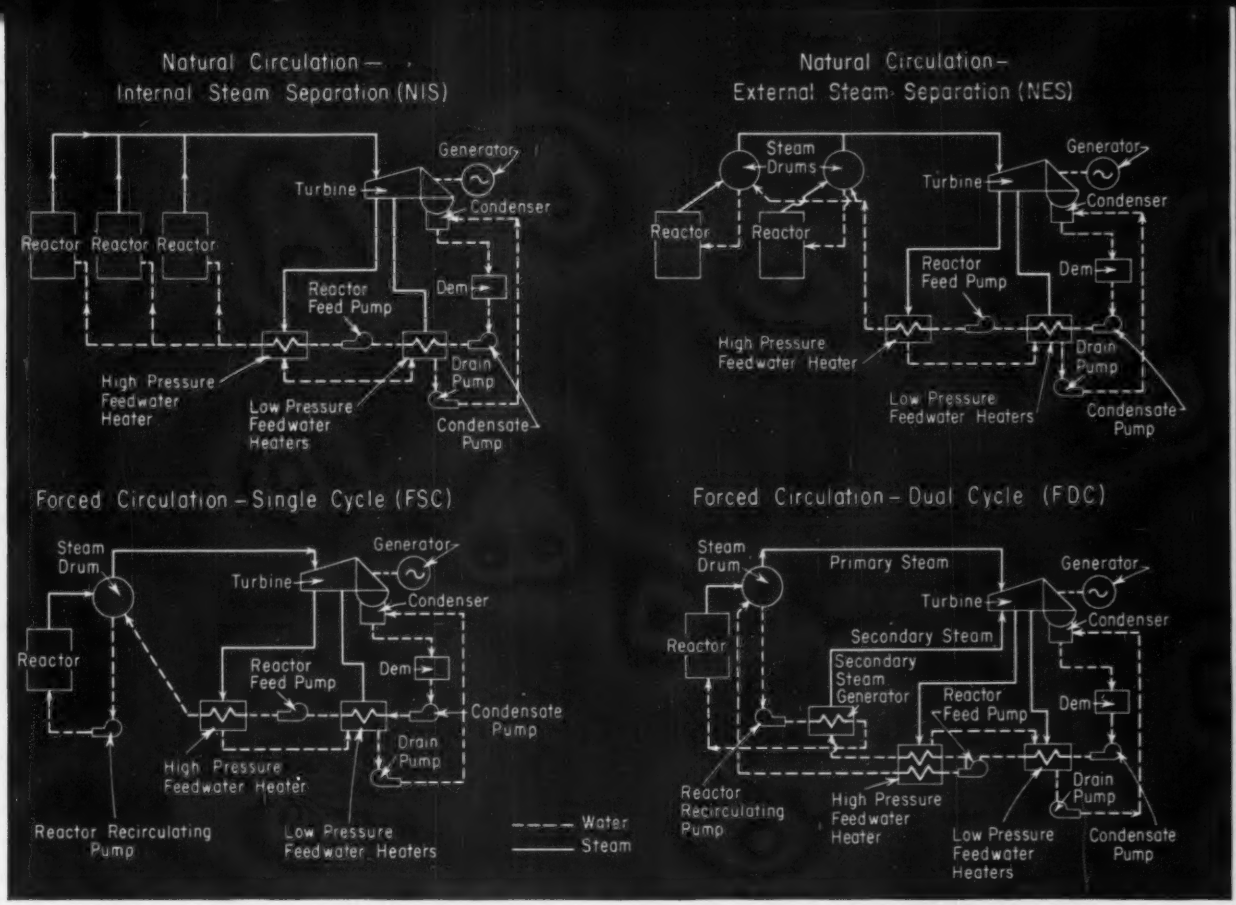



**FIG 1—FOUR BOILING WATER REACTORS** studied range from simple natural-circulation plant to dual cycle with forced flow. Study indicated that development may make single-cycle concepts as attractive as dual cycle

# Study of 4 BWR Concepts Shows One-Unit 300-Mw Plant Feasible

## Analysis shows that a single-unit station based on current technology would yield energy cost about 1 to 1½ mills higher than conventional station with 35-cent fuel cost

**DR HENRY C. OTT**, Nuclear Consultant
**ROY H. GORDON**, Project Engineer,
Nuclear Engineering Division,
Ebasco Services, Inc., New York

A study of large boiling water reactors for central station application indicates that it is feasible to build a dual-cycle, forced-circulation, boiling water reactor plant based on reasonably well proven 1959 technology. It also shows that a 300-Mw single-unit station, using primary steam at 950 psig, and optimized for lowest cost would yield an energy cost about 1 to 1½ mills higher per kwhr than an equivalent coal-fired station with a fuel cost of 35 cents per million Btu. However, selection of these plant parameters does not imply that the dual cycle is necessarily the most promising boiling water concept in the long run. Other boiling water cycles, considered in the study, showed comparable energy costs and may prove to be more attractive as development of the art progresses.

Ebasco Services Inc, aided by the General Electric Co, undertook the study as part of the AEC's atomic power program.

Goal of the study was a conceptual design for a boiling water reactor powered central station to produce the lowest cost energy consistent with two fundamental requirements:

**1.** The research and development for the selected system was to be sufficiently limited to permit construction to start in July 1960. This required a design based upon proven technology with a minimum of extrapolation.

**2.** The plant had to be conceived, designed, and built so as to be operable in a utility system responding in a satisfactory way to the usual commercial demands with respect to availability, reliability, durability and flexibility.

Since a study of this type can be

performed under a variety of governing conditions, a basic set of conditions was formulated at the outset. These conditions are realistic and generally in agreement with current utility practice:

- The unit shall operate at an 80% load factor and obtain a useful life of at least 30 years. Realism of this load factor can be argued on the basis that, once the nuclear plant is installed, its fuel costs will be considerably lower than the fossil fuel costs of sister units.
- Total capital cost shall include all overhead investment items such as escalation, interest during construction, land and substation, working capital, and plant startup.
- Annual fixed charges shall be 14% of the total capital investment.
- The unit shall be installed at a new site, the development of which shall be based upon the peculiar requirements of nuclear installation. Hypothetical site conditions were specified by the AEC.
- To assure maximum safety no compromises shall be made in the provisions for containment and shielding.
- Nuclear fuel costs shall be based upon established AEC rates and charges.

It was apparent from the outset that the goal of minimum energy cost would be attained from a relatively large unit. Also one of the fundamental requirements calls for a unit size consistent with current practice. Hence economic comparisons were made primarily for plants of 200 to 300 Mw electrical output. A survey of the sizes of plants completed in recent years and plans for construction by utility companies indicated the applicability of this capacity unit.

Investigation of the most economical conditions rested in part upon a determination of the optimum steam pressure for the cycles under study. This factor and the matter of superheat are discussed.

## Table I—Principal Design Variations for Selection of Optimum Plant

| | 200 Mw Range | | | | 300 Mw Range | | |
|---|---|---|---|---|---|---|---|
| **Cycle** | **NIS** | **NES** | **FSC** | **FDC** | **NES** | **FSC** | **FDC** |
| **Generator** | | | | | | | |
| Gross Output—Mw | 210 | 210 | 207 | 207 | 312 | 313 | 303 |
| Auxiliary Power—Mw | 10 | 10 | 12 | 12 | 15 | 18.7 | 18 |
| Plant Net Electrical Rating—Mw | 200 | 200 | 195 | 195 | 297 | 294.3 | 285 |
| Reactor Power—Mw | 642 | 642 | 610 | 628 | 954 | 958 | 919 |
| Net Station Heat Rate—Btu/kwhr | 10,957 | 10,957 | 10,676 | 10,992 | 10,964 | 11,110 | 11,006 |
| Reactor Operating Pressure—psia | 1,015 | 1,015 | 1,325 | 1,015 | 1,040 | 1,015 | 1,015 |
| Turbine Throttle Pressure—psia | 965 | 965 | 1,265 | 965 | 965 | 965 | 965 |
| **Steam Flow** | | | | | | | |
| Primary—lb/hr × $10^6$ | 2.3 | 2.3 | 2.25 | 1.9 | 3.4 | 3.35 | 2.75 |
| Secondary—lb/hr × $10^6$ | ..... | ..... | ..... | 0.58 | ..... | ..... | 0.85 |
| **Feed-Water Return Temperature—F** | 267 | 267 | 280 | 350 | 267 | 250 | 350 |
| **Reactor** | | | | | | | |
| Number of Vessels | 3 | 2 | 1 | 1 | 2 | 1 | 1 |
| Average Core Power Density—kw/liter | 30 | 27 | 36 | 36 | 27 | 36 | 36 |
| Core Flow per Reactor—lb/hr × $10^6$ | 12.8 | 17.4 | 27.2 | 22.1 | 28.5 | 55.9 | 32.3 |
| Core Exit Quality—lb steam/lb coolant | 0.06 | 0.06 | 0.08 | 0.08 | 0.06 | 0.06 | 0.08 |
| Core Inlet Subcooling—Btu/lb | 18.5 | 24.2 | 29.8 | 45.3 | 18.6 | 19.6 | 45.3 |
| Number of Fuel Assemblies per Reactor | 225 | 76 | 97 | 97 | ..... | ..... | ..... |
| Number of Fuel Rods per Assembly | 36 | 144 | 196 | 196 | 97 | 120 | 120 |
| Active Fuel Length—in | 79.1 | 95 | 107 | 109 | 112 | 129 | 129 |
| No. of Control Elements per Reactor | 45 | 57 | 76 | 76 | 76 | 97 | 97 |
| Pressure Vessel—ID—in | 135 | 120 | 133 | 133 | 134 | 147 | 147 |
| Pressure Vessel Inside Length—ft | 42 | 34 | 37 | 37 | 40 | 42 | 43 |
| **Steam Drum** | | | | | | | |
| Number and Length each (dia 8 ft)—ft | ..... | 2–42 | 1–66 | 1–54 | 2–69 | 2–64 | 1–78.5 |
| **Pumps** | | | | | | | |
| Number | ..... | ..... | 4 | 4 | ..... | 6 | 4 |
| Flow (each) Hot—gpm | ..... | ..... | 19,400 | 15,000 | ..... | 25,500 | 21,800 |
| Hp (each) Hot—hp | ..... | ..... | 575 | 700 | ..... | 877 | 755 |
| **Secondary Steam Generators** | | | | | | | |
| Number | ..... | ..... | ..... | 4 | ..... | ..... | 4 |
| **Risers** | | | | | | | |
| Number per Reactor | ..... | 6 | 6 | 6 | 8 | 6/12 | 8 |
| Diameter—in | ..... | 22 | 22 | 20 | 22 | 28/22 | 22 |
| **Downcomers** | | | | | | | |
| Number per Reactor | ..... | 4 | 4 | 4 | 4 | 6 | 4 |
| Diameter—in | ..... | 24 | 24 | 22 | 28 | 28 | 24 |
| **Containment Vessel** | | | | | | | |
| Diameter—ft | 170 | 160 | 170 | 170 | 215 | 190 | 200 |
| Design Pressure (internal)—psig | 1 external | 16.5 | 30 | 22 | 18 | 30 | 24 |

## Table II–Comparative Differential Capital and Energy Costs for Alternative BWR Plants

| Plant Nominal Rating—Mw | 200 | | | | 300 | | |
|---|---|---|---|---|---|---|---|
| Unit Net Capability—Mw | 200 | 200 | 195 | 195 | 297 | 294.3 | 285 |
| Cycle | NIS | NES | FSC | FDC | NES | FSC | FDC |
| Turbine Throttle Pressure—psig | 950 | 950 | 950 | 950 | 950 | 950 | 950 |
| **Differential Capital Cost—$ Per Net Kw** | | | | | | | |
| Engineering and Construction | | | | | | | |
| Land | +0.54 | +0.54 | +0.59 | +0.59 | −0.05 | −0.04 | Base |
| Base Plant | +31.41 | +39.19 | +34.06 | +35.16 | −1.00 | −1.00 | Base |
| Turbine Generator | +5.60 | +5.60 | +5.60 | +7.60 | −1.66 | −1.66 | Base |
| Nuclear Steam Supply | +15.04 | −0.22 | +3.90 | +1.60 | +5.02 | +9.27 | Base |
| Containment | −0.18 | −0.75 | +0.99 | +0.45 | +1.77 | −2.70 | Base |
| Total (Items 1 to 5) | +52.41 | +44.36 | +45.14 | +45.40 | +4.08 | +3.87 | Base |
| Total (Referred to NES Plant) | +8.05 | Base | +7.12 | +1.04 | | | |
| Interest During Construction | +4.19 | +3.55 | +4.12 | +3.63 | +0.33 | +0.31 | Base |
| Plant Start-Up | +1.08 | +0.95 | +0.95 | +0.92 | +0.02 | −0.03 | Base |
| Working Capital | +2.11 | +0.92 | +0.79 | +0.91 | −0.01 | +0.03 | Base |
| Total (Items 6 to 10) | +59.79 | +49.78 | +50.56 | +50.86 | +4.42 | +4.18 | Base |
| **Differential Energy Costs—Mills Per Net Kwhr** | | | | | | | |
| Fixed Charges at 14% | +1.20 | +1.00 | +1.01 | +1.02 | +0.09 | +0.09 | Base |
| Operation and Maintenance | +0.20 | +0.17 | +0.17 | +0.16 | +0.01 | +0.01 | Base |
| Third-Party Liability | +0.07 | +0.07 | +0.07 | +0.07 | 0 | 0 | Base |
| General and Administrative | +0.04 | +0.03 | +0.03 | +0.03 | 0 | 0 | Base |
| Nuclear Fuel | +0.29 | −0.01 | −0.04 | 0 | −0.01 | +0.02 | Base |
| Total (Items 12 to 16) | +1.80 | +1.26 | +1.24 | +1.28 | +0.09 | +0.10 | Base |
| Total (Referred to FSC Plant) | +0.56 | +0.02 | Base | +0.04 | | | |

Four alternate boiling water cycles were investigated:

- A natural-circulation reactor system employing internal steam separation, identified herein as the NIS plant.
- A natural-circulation reactor system with a separate drum for steam separation, designated NES plant.
- A forced-circulation reactor system with a separate drum for steam separation, the FSC plant.
- A forced-circulation reactor system with a separate steam drum and secondary low-pressure steam generation, thus providing dual steam supply to the turbine, the FDC plant.

Simplified flow diagrams of these four cycles are shown in Fig 1.

### Four Cycles Detailed

The NIS system employs natural circulation with internal steam separation. It is the simplest boiling water reactor cycle, and its containment volume and pressure requirements are minimal. However both the effectiveness of steam disengagement and core flow rate limit the dimensions of the reactor vessel and it appeared that 75 Mw was the largest single NIS capacity unit. Such a plant is not likely to yield the minimum energy cost goal. Nonetheless a large generating unit can be realized by coupling several NIS reactors to a single large turbine-generator. And with these reactors all in a common containment vessel, the design of this vessel can still be quite modest. The 200 Mw NIS plant was based on the use of three reactors. The study showed, however, that the cost of multiple reactor vessels, with attendant in-

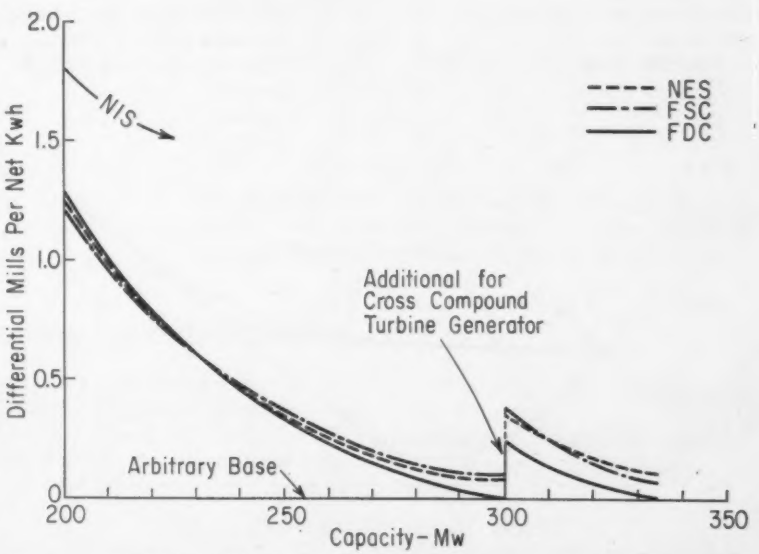



**FIG 2—OPTIMUM CAPACITY IS 300 MW.** Close agreement of estimated curves indicates no one cycle was proved economically superior

creased complexity of auxiliaries and piping, offset the cost advantages of cycle simplicity. Thus the NIS plant showed the highest energy cost at 200 Mw and was not investigated at higher output.

**The NES system** considered differs from the NIS cycle only in the addition of an external elevated drum for steam separation. This NES concept retains the advantage of natural circulation but provides more economical steam disengaging area and a greater driving force for recirculation by virtue of drum elevation. Resulting greater coolant flow permits higher power density. Still, the costs of interconnecting alloy piping and of supporting structures, the size of the reactor containment vessel and other considerations place an upper limit of perhaps 150 Mw on a single NES reactor. As in the case of the NIS cycle the use of multiple reactor units coupled to a single turbine-generator is feasible. Hence the 200 Mw and 300 Mw studies are based on use of two reactors in a single containment vessel.

**The FSC plant** uses a forced-circulation single cycle similar to the previous except that mechanical circulation pumps are employed rather than depending on natural circulation. Increased coolant flow by forced circulation makes 300 Mw from a single reactor vessel of reasonable size attainable. The cost of installing and operating the circulating pumps is offset by the savings in reactor vessel and other system costs.

**The FDC cycle** or dual-cycle concept is so named because in addition to feeding steam to the turbine from the steam drum, heat in the primary water generates secondary low pressure saturated steam in a second loop for admission to an intermediate stage of the turbine. The principal advantage of the dual cycle results from the substantial subcooling of the inlet reactor coolant (cooling of the inlet reactor coolant below the boiling point). This permits a higher power output for a given core flow and average void fraction or, conversely, lower coolant flow and higher core exit quality for a given power output. The extra cost of the secondary steam generators is largely overcome by the reduction in the size of the steam drum and in the capacities of the primary circulating pumps.

### FDC Regulates Self

An important feature of the FDC reactor system is a self-regulation of the reactor power level with changes in turbine steam demand. The primary steam flow is regulated to maintain constant reactor pressure regardless of load while fluctuations in load demand are met through varying secondary steam flow by the turbine speed governor. A decrease in secondary steam flow is reflected in an increase in temperature of the reactor inlet coolant, which increases the void fraction and hence decreases the reactor power. This is in contrast to the single-cycle boiling water reactors studied where closing of the turbine throttle increases reactor pressure, thereby reducing the void fraction with an attendant increase in the excess reactivity and hence the reactor power. This requires control rod movement in response to load fluctuation (or alternatively bypassing excess steam to the condenser), whereas the dual-cycle provides self-regulation over a range of roughly 40% to 100% full power with no movement of the control rods. The FDC requires control rod movement only for shutdown and adjustment of the power range.

### Dual Cycle's Efficiency Good

Table I presents the principal design characteristics for these four alternate boiling water reactor plants investigated at 200 and 300 Mw nominal outputs (except NIS at the higher output). It is interesting to note that the single-cycle plants do not show an overall efficiency greater than the dual cycle, despite the use of considerable low pressure steam for the latter. This results primarily from the requirement for low feedwater return temperature for the single-cycle plants to obtain subcooling, an essential for realistic core design, to achieve minimum reactor cost with reasonable stability. The dual-cycle plant may return hotter feedwater since it is subcooled by heat exchange in the secondary steam generators before reentering the reactor as coolant.

Other significant design variations among the four conceptual designs to be noted in Table I are these:

- Core coolant flow at 200 Mw varies from 38.4 million lb per hr for the three NIS reactors to about 60% of that value for the FDC plant, a wide difference in characteristics.
- In keeping with this variation in coolant flow is a substantial difference in steam drum length.
- Each of the three reactor vessels in the NIS plant is actually larger than the single reactor vessel for either forced-circulation plant of equal output. This reflects the lower average core power density of the NIS reactor and its extra volume required for steam separation. This is not too surprising because it is primarily the size of the reactor vessel that limits the power output of the individual NIS reactor.
- The advantage of a greater subcooling and higher permissible core exit quality in the FDC cycle is

(*Continued on page* 80)

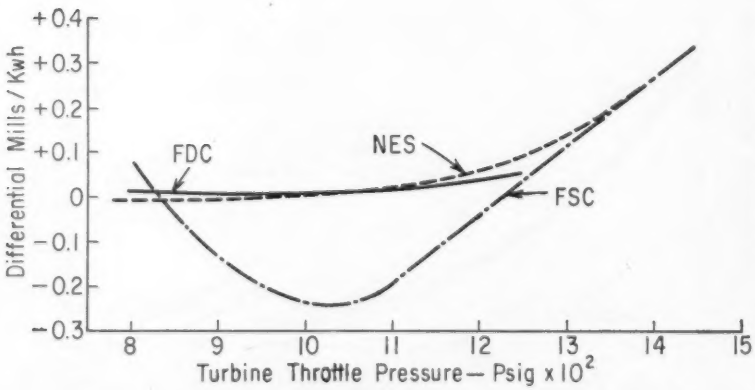
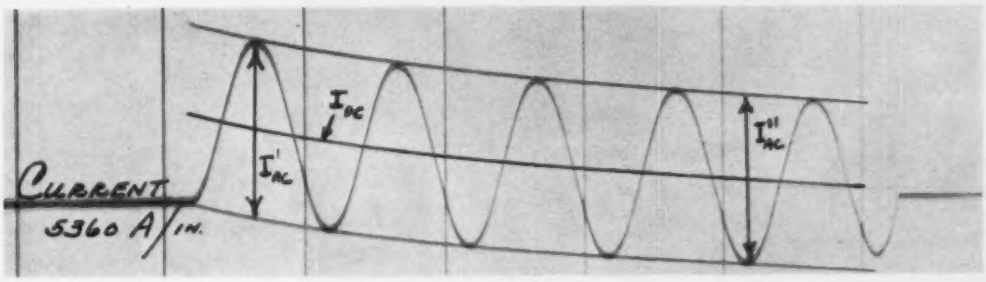



FIG 3—MOST ECONOMICAL PRESSURES were found nearly same for all cycles. Energy cost part of study was made at 950 psig for all cases




# Calculate X/R Ratio for Test Circuits

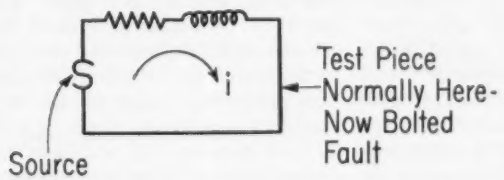
**J. E. HARDER**, Distribution Apparatus Engineering, Westinghouse Electric Corp, Bloomington, Ind.

Where reclosers, switches, cutouts, circuit breakers and other equipment must be tested for application on circuits of specified $X/R$ ratio, it is desirable to determine the $X/R$ ratio of the test circuit easily. This can be obtained from an oscillogram of the bolted fault current.

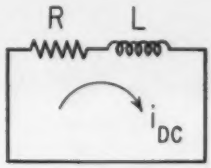
For this method of calculation it is necessary to start with a current which has a dc component. In general this current has two decrements, as shown in the oscillogram above.

$I_{dc}$, the dc component of the current, starts at a maximum value and diminishes exponentially to zero. (There is also an ac decrement so that $I''_{ac}$ will generally be less than $I'_{ac}$. Therefore, $I_{dc}$, which is midway between the envelope curves, is not parallel to either.) This method for determining $X/R$ ratio is based on measuring the time for the dc component to drop to 0.368 times an original value.

Reduced to its important components for the $X/R$ ratio consideration, the test circuit looks like:




Eliminating the ac (steady state) portion of the current leaves:




for which the equation is

$$0 = L\frac{di_{dc}}{dt} + i_{dc}R$$

solving for $i_{dc}$

$$i_{dc} = i_o e^{-\frac{R}{L}t}$$

where $i_o$ is an assumed initial current. Then $i_{dc}$ is thought of as being a direct current component which decays exponentially with time. In one time constant ($t = R/L$) the direct current drops to 0.368 times its original value, but

$$L = \frac{X}{2\pi f}$$

and $t_{\text{seconds}} \times f_{\text{cycles/sec}} = t_{\text{cycles}}$

therefore

$$i_{dc} = i_o e^{-\left(\frac{2\pi}{X/R}\right)t_{\text{cycles}}}$$

So, if the time for $i_{dc}$ to drop to 0.368 times any original value (time constant) is measured in cycles, then $X/R$ = time constant in cycles multiplied by $2\pi$.

## Seven Steps Required to Determine the X/R Ratio

**1.** Draw the line of zero current and the envelope of the current wave.

**2.** Draw the dc component one-half way between the top and bottom envelope.

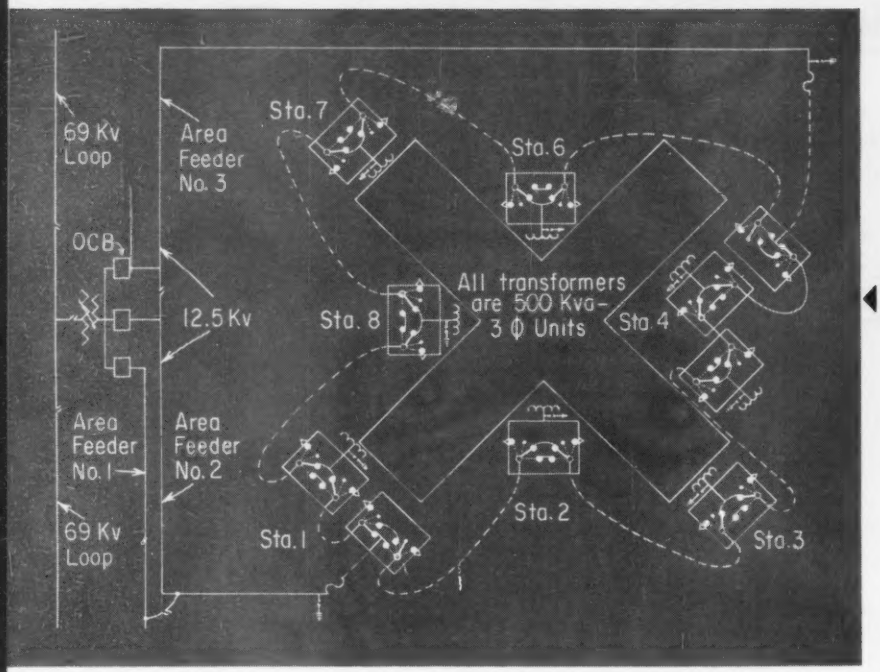
**3.** Measure the value of the dc component (in inches) at some convenient point, generally about the time of the maximum current of the first major current loop. Call this point in time "Time A."

**4.** Multiply this value (from Step 3 in inches) times 0.368. (O.368 is $\frac{1}{e}$.)

**5.** Determine where in time the dc component is equal to the value obtained in Step 4. Call this point in time "Time B."

**6.** Determine the time in cycles (of ac component) from Time A to Time B.

**7.** $\frac{X}{R} = 6.28$ x (time in cycles from Time A to Time B). (6.28 is $2\pi$.)




**Sectionalized primary loop for . . .**

**New 30-acre shopping center shows . . . .**

# Cooperation

**FRANK J. KASTL,** Southwestern Public Service Co, Lubbock, Texas

Coordinated planning with the architect and the developer helped Southwestern Public Service Co provide dependable and flexible service to a new 30-acre shopping center on the outskirts of Lubbock, Texas. The simple, practical, and attractive design uses a primary loop, load center system, with underground service and a single transformer size in all load centers. The versatile design has already proven its ability to cope with fault conditions and with load changes.

The design was chosen after comparative evaluation of: initial investment by the utility, developer, and shopowners; service continuity; flexibility to handle load changes; protection against faults; cost of operation and maintenance; voltage regulation; and efficiency.

Laid out in the form of a large "X," with a 50-ft wide internal mall, the Monterey Shopping Center accommodates 43 to 46 shops, all facing on the mall. The buildings have 237,000 sq ft of ground space and 96,000 sq ft of second story space. The rest of the tract is illuminated parking area.

The shopping center is about two miles from a 69-12.47-kv "Y" substation which is fed by a 69-kv loop. Since service continuity is important, two 336.4-Mcm ACSR shielded 12.5-kv circuits were made available to serve the center by separate routes. This developed into a sectionalized primary underground loop, with each half of the loop feeding four 500-kva substations. The primary underground system was installed and will be maintained at no expense to the developer.

### Secondary Net Ruled Out

Several systems were considered to provide service to the center. Underground service was specified by the builder. Use of a primary metered utility center was quickly ruled out because of the size of installation and the difficulty in allocating utilities and service to tenants on an equitable basis.

A secondary network system in a tunnel shared by all utilities was infeasible for several reasons:

- The area beneath the mall could not be used since all service runs would be long and under buildings.
- Estimated cost for a 5,000-ft tunnel around the perimeter was $100 per ft.
- Gas meters could not be located in the same tunnel without its being classified a hazardous area.
- A secondary network on two primary feeders requires double capacities of transformers and cables.

Certain areas that would otherwise be wasted space were designated by the architect for electrical distribution substations and metering points. Ground enclosures house the transformers, primary switches and meters, eliminating the problems of underground vaults. The enclosures have three masonry walls and a steel deck roof. The open front, which faces the building, is closed with a panel of chain-link fence and an 8-ft gate. The developer provides the ground enclosures and underground services from meters to individual tenants.

A study was made of the connected electric loads, based on utility load data and the architects experience with all types of businesses. Anticipated loads near the ends of the "X" were 450 kw and are expected to remain about the same. The inner locations are expected to have a 350-kw load initially, with an increase of about 5% a year. Assuming a peak load demand of 70%, a 500-kva substation would be sufficient for several years.

Using only one transformer size —500 kva—in all eight substations reduced long-term cost. Three-phase transformers were selected

# Is Key to Reliability

because they have lower failure rate, smaller space requirements, fewer connections to make and maintain, neater appearance, and greater safety for operating people.

Feeders coming into the shopping center are 15-kv, 4/0 copper, shielded, rubber insulated cable. 200-amp fused disconnects, coordinated with oil circuit breakers at the 69-12.5-kv substation, are used between the overhead and underground conductors. Cables and transformers are protected from surge voltages by lightning arresters at each transformer. For mechanical and physical protection, cables were pulled into 5-in. fibre conduit encased in concrete 36 in. deep.

### Switches Manually Operated

Oil-immersed load-break selector switches rated 400 amp, 15 kv are located at each transformer and on each feeder. These switches have pothead compartments for cable termination and roof bushings for open-wire connections to the transformers. Manual operation of the switches will permit:

**1.** Energizing the transformers with the loop opened or closed

**2.** Isolating any transformer or section of the underground cable

**3.** Paralleling, separating, or ioslating feeders

**4.** Using 1/0 copper cable instead of 4/0 in the loop

**5.** Isolating any section of the primary cable for grounding, testing or replacement.

The 500-kva transformers require three 500-Mcm copper cables per phase on the low side. If the transformers are eventually replaced by 750-kva units, one additional cable per phase will be added. Premolded insulated connectors proved more appropriate than 2,000-amp plug-in duct. This type of connection can be made or removed with the bus "hot" or "cold." Each service is fused individually with limiters. Loose connections are eliminated by using compression or cone-and-nut type connectors. The masonry interior walls are utilized for secondary bus support and meter locations. Slotted metal brackets are used to attach the secondary cable bus to the walls.

The number of services in each enclosure varies from four to sixteen. Services are 50 to 150 ft in length, which is not excessive for a 125/216-v system if adequate cable capacity is provided. Initial cost savings of 7 to 9% were realized by using a 3-phase grounded wiring system. The high sides of the transformers were delta connected to eliminate third harmonics.

At present the connected load on station No. 1 is 425 kw, with a 225-kw 30-min peak demand. This station serves a 25,000-sq ft supermarket, a service station and a portion of the parking area lighting.

Station No. 2 serves at present eleven customers with a connected load of 480 kw and a 220-kw peak demand. These are small shops except for a 20,000-sq ft variety store whose peak demand is 96 kw. Seven larger shops impose nearly identical connected and peak load on station No. 8.

### Reduce Lamp Voltage

Shortly after the first supermarket opened, the customer expressed concern that 125 v might shorten the life of ballasts and fluorescent lamps. This presented a problem, since all transformer primary taps were below normal and could not be connected to lower the secondary voltage. After some study, bucking transformers were installed in five locations and transformers in three other locations were replaced in order to maintain 120/208 volts. Only one 3-phase motor trouble has occurred. This was corrected when the service was enlarged.

The largest building is a 60,000 sq ft 1½ story department store. The connected load will be 1,600 kw, including four 50-hp motors. This building will be served from station No. 4 at 277/480 v, since 120/208 v is not suitable for the large load and the 310-ft service run. The customer will step down 175 kw to 120/240 v for incandescent lighting and 120-v equipment.

The versatility of the entire system has been proven beyond expectations. In the first stage, approximately one-third of the primary conduit was installed and station No. 1 was completed and energized. In the next stage, the primary cable was pulled each way to enclosures No. 2 and No. 8. One phase of the cable to station No. 2 faulted to ground, evidently due to a pin hole made during shipment. Approximately 70 ft of conduit had to be exposed and reinstalled. A cable splice was made without service interruption to any customer. Before the next stage was completed, two enclosures had to be combined because the increased size of a department store made one of the enclosure locations unavailable.

# Procurement & Products

**CYCLES** ▶ **Another plea to smooth out the buying cycles** has come from J. S. Parker, vice president, General Electric Co. Parker told the annual meeting of the Southeastern Electrical Exchange that "tendencies toward cyclical buying, and the resulting significant swings in employment, create situations that are made-to-order for the campaigns of labor leaders seeking the introduction of the so-called 'guaranteed annual wage' and similar unsound ideas." He said the whole industry, including manufacturers, should plan its way "out of the valleys and through the peaks." Otherwise, "it will be the customers who will pay in the long run."

**METALS** ▶ **Signs pointed to further retreat in copper prices** last week. Fabricators were cutting back inventories. Some merchants say a little over 32¢ would be reasonable for a month ahead, reported Engineering and Mining Journal's weekly markets newsletter. Average domestic pricing last week was 33¢ a lb delivered. Aluminum prices held firm and February production ran at 81.9% of the industry's capacity, compared with 80.2% in January.

**SUPPLIERS** ▶ **Federal Pacific Electric Co will open customer service facilities** in Norwood, Mass.,—transferring the present Boston service center to expanded facilities in Norwood. Integrated engineering, field service, production, warehousing, and sales departments for serving area markets will be housed in Norwood. Federal Pacific also announces new packaging designs for shelf items. The new corporate FP symbol is incorporated in all packaging.

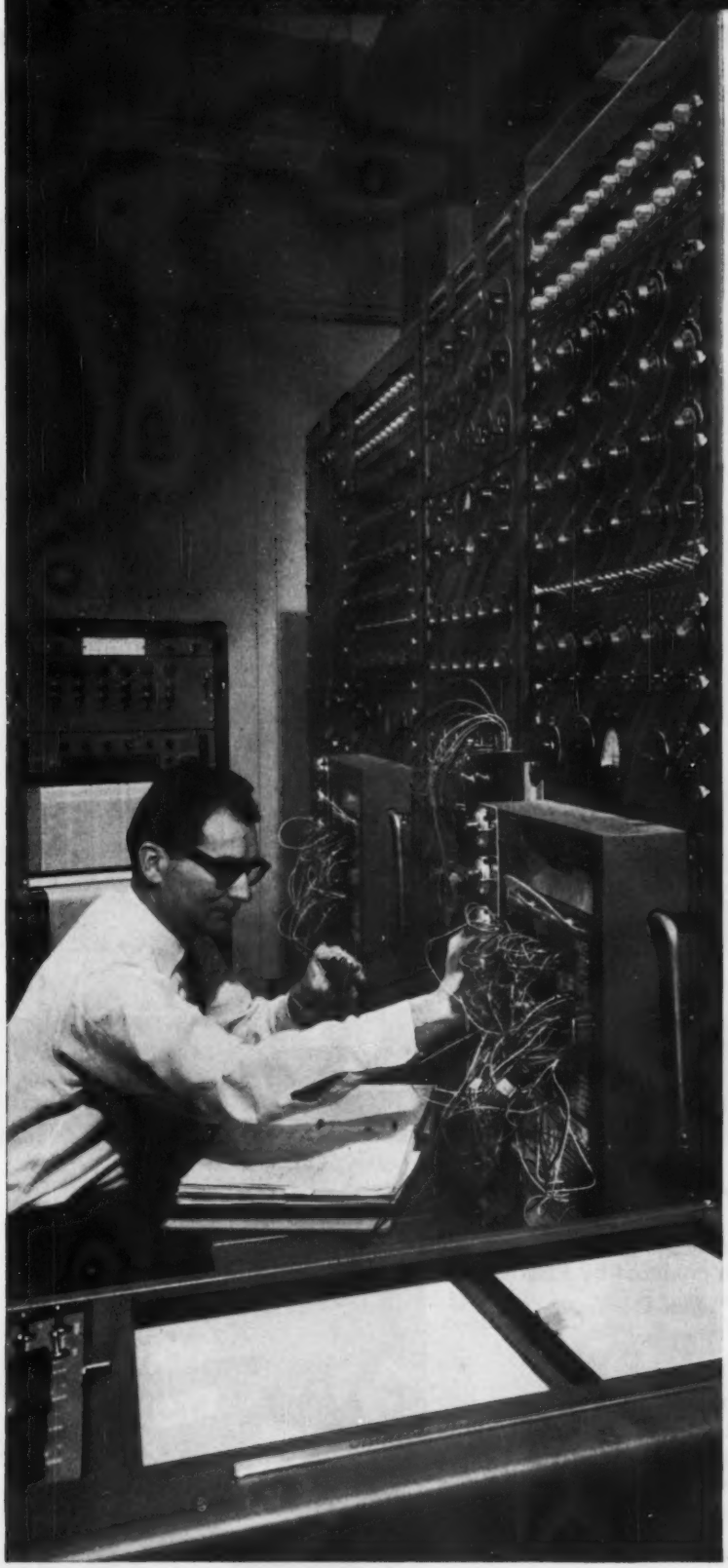
**COAL** ▶ **To provide more efficient coal mining operations,** Peabody Coal Co has ordered a power shovel capable of loading 173 tons of coal at one scoop. The shovel will contain 52 electric motors ranging from one-fourth to 3,000 hp, and will reportedly use as much electricity as a city of 12,000 people.

**STORES** ▶ **New booklet of money-saving tips for storeroom operators** is available from Manpower, Inc. While written primarily for the production plant stock and shipping operations, many of the suggestions can be applied directly or adapted to utility storeroom procedures. It contains pointers on equipment, employee, and administrative problems.

**Some of the suggestions come right from utility experience,** and indicate the savings to be made or the advantages to be gained. The booklet entitled "100 Ways to Save Money in packing, shipping, and stockroom operations" may be obtained free from Manpower, Inc, 820 N. Plankinton Ave, Milwaukee, Wis.


News of Manufacturers ..... page 44
New Equipment ..... page 50
Readers Service ..... page 54

ANOTHER STEP AHEAD IN VOLTAGE REGULATION



*COMPUTER STUDIES BY GENERAL ELECTRIC PROVE . . .*

# Reduced Regulator Bandwidths Increase System Earnings

General Electric voltage regulators provide three added benefits to distribution systems through bandwidth reduction . . . extra feeder length, capacity, and revenue! New General Electric computer studies now prove that *reduced regulator bandwidths are practical* and that they result in increased distribution system performance with *no sacrifice of regulator life.*

Electric utilities have long recognized the desirability of bandwidths as low as ±¾ volts. The assumed stumbling block was the number of regulator operations. Through analysis of actual (as opposed to theoretical) data, new General Electric computer studies indicate that bandwidths of ±¾ volts are feasible from any standpoint, including that of equipment life.

Your General Electric regulator representative can show you the specific effects on regulator operation as bandwidths are reduced. He will show you how to determine if operations must be controlled . . . and if so, how to control them. Increase the return on your regulator investment, possibly with your existing equipment.

Take full advantage of the important benefits of General Electric ML-32 step regulators. Reduced bandwidths provide more *usable* kva on the line . . . permit increased loading of existing feeders. This easily attainable "power adder" can mean increased line length and capacity—important tools to reduce or defer investment. Reduced bandwidth settings make significant contributions to feeder revenue, too!

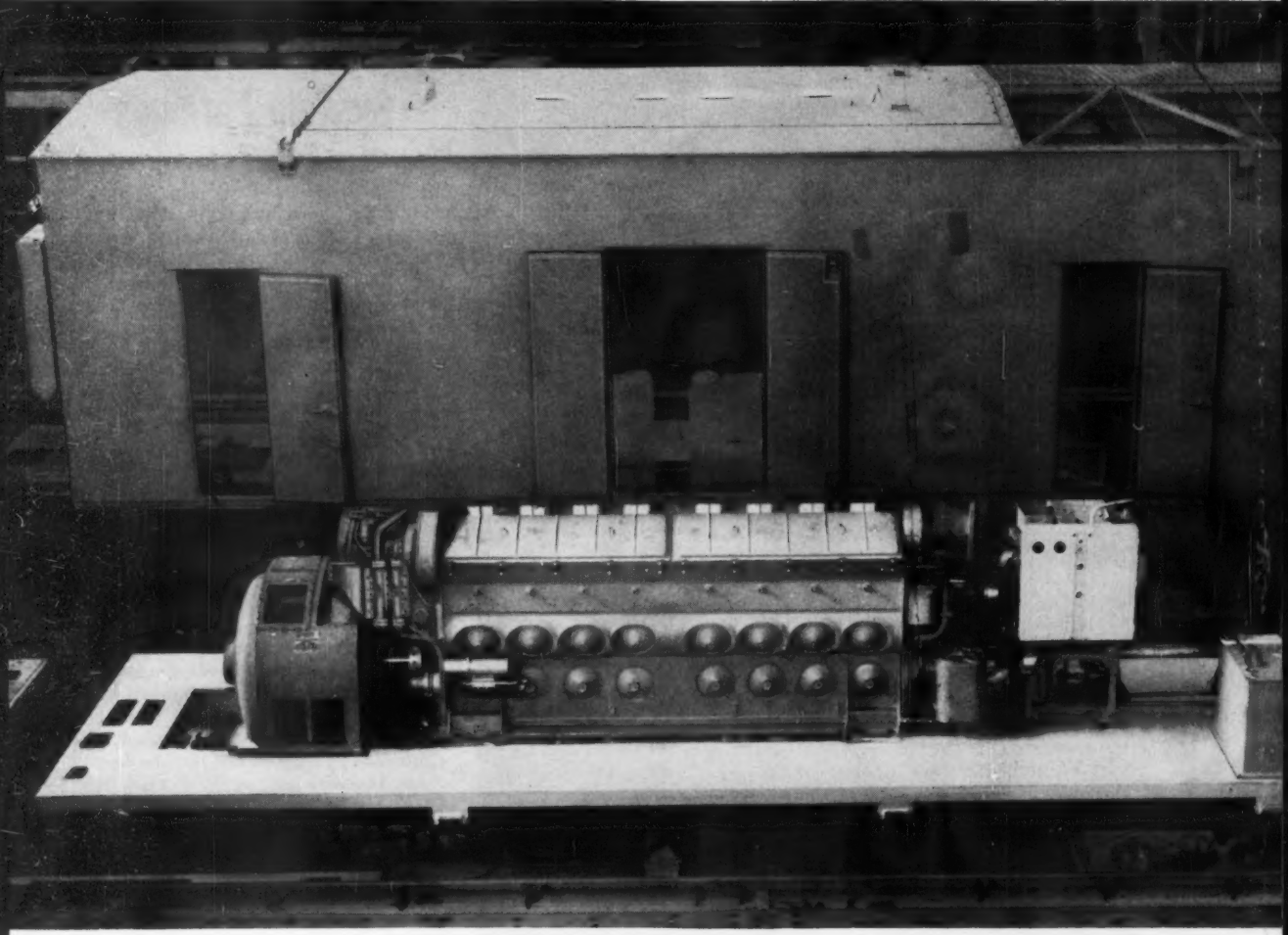
And contact your General Electric sales engineer for even more reasons why General Electric regulators cost less on the line! General Electric Company, Schenectady 5, N. Y. 436-02

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

*Push-button peaking plant . . .*

# FROM COLD START TO



Weather-proofed, sound-deadened housing is lowered over prime mover, generator and supporting auxiliaries. More than 20,000 prime movers and generators have been produced by Electro-Motive over a twenty-one year period.

Entire plant as it appears installed at the step-down substation serving the load. Self-contained, outdoor-type units require no expensive building or complicated foundation work. From time of order to complete installation requires less than five months.

# FULL LOAD IN 90 SECONDS

## Electro-Motive MU-60 provides automatic, unattended supply for peak loads, system reserve, area protection

Within 90 seconds from starting signal, the unattended 6000 KW Electro-Motive plant is on the line at full load—providing an immediate and economic answer to problems of peak demand and spinning reserve. A look inside reveals why this quick response is possible:

First, the MU-60 is composed of components that have been applied to a wide range of applications over a 21-year development period. In thousands of hours, under all kinds of operating conditions, their records of performance have set new standards of reliability, durability, and low maintenance. The result is a standardized plant featuring low first cost,* and low operating and maintenance costs.

Second, the MU-60 prime mover—the famous General Motors 567 series two-cycle Diesel engine—is inherently suited to fast starts and changing loads with long service life.

Finally, the plant's basic control equipment provides for unattended automatic operation at a remote location which makes it an ideal choice for area protection.

Because of standard components and design simplicity, the MU-60 has a high degree of flexibility and operational advantages. For example:

- **Unitized, self-contained design permits economical installation of less than $15 per K.W.**
- **Application at points of load reduces line loss from central locations.**
- **Building-block principle of application permits fitting power needs to area demand and growth.**
- **Plant may be increased in capacity at low incremental cost.**

Ask your Electro-Motive representative for additional information about the economy and operational advantages of the Electro-Motive peaking plant.

**$85 per kw, f.o.b., LaGrange, Ill.*

**ELECTRO-MOTIVE DIVISION**
**GENERAL MOTORS** • LA GRANGE, ILLINOIS

**Sales-engineering offices:** Chicago, New York, St. Louis, San Francisco

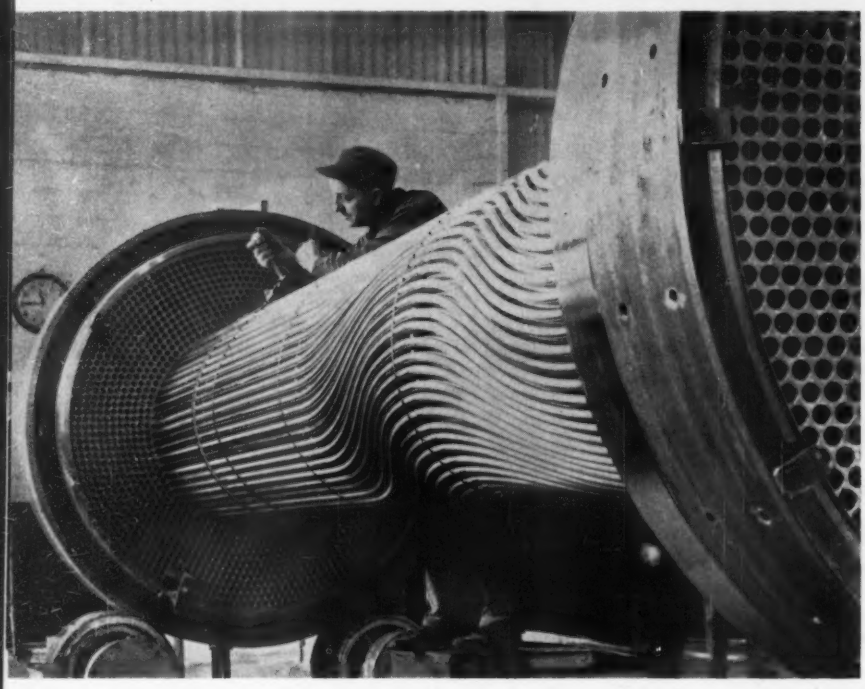
**In Canada:** General Motors Diesel Limited, London, Ontario

# Alco Puts Sine Curve in Enrico Fermi's Tubing

Unusual tubing with sine curve (below) is being installed in three sodium heat exchangers being built by Alco Products' thermal products division for Power Reactor Development's Enrico Fermi atomic power plant. More than 19 miles of stainless steel tubing was supplied by Allegheny Ludlum Steel to Alco, who put the sine curve in it.

The exchangers are the largest units built to date, Allegheny believes. The 88-in.-dia shells have 16-in.-dia shielding, nearly 31 ft long. Completely assembled, each exchanger weighs 130,000 lb. Cost of the three unit is estimated to run to about $1,750,000.

Type 304 stainless steel tubes, 18 ft long with ⅞-in. outside dia and 18-gauge minimum wall thickness is being used. To put the sine curve in them, tubes are bent cold on a machine especially designed by Alco. The sine curve, a compound curve required because of space limitations and flow direction in the exchanger, accommodates differences in thermal expansion in in the tubing.



The second unique aspect of these units is that the tube bundle can be removed easily from its shell, facilitating maintenance work. Most exchanger units in nuclear applications are of all-welded, integral construction and must be cut apart for repair, points out Robert M. Church, Alco chief project engineer.

Liquid sodium removes heat from the Fermi nuclear reactor, circulating through the reactor core and blanket to the heat exchanger. A second sodium system transfers heat from the exchanger to a steam generator, producing steam which turns a turbine directly connected to an electric generator.

Tube bundles have a gasketed joint which separates the primary from secondary sodium fluids. Springs 10-in. long act as load members for setting and sealing this joint.

Each of the exchangers is designed to transfer 489,000,000 Btu per hr at flow rates of 12,500 gal per min. Primary sodium coolant flows by gravity from the reactor at a temperature of 900F through the shell side of the unit to the pump, from which it returns to the reactor at 600F.

# Possible Future Use of Electronic Computers Described

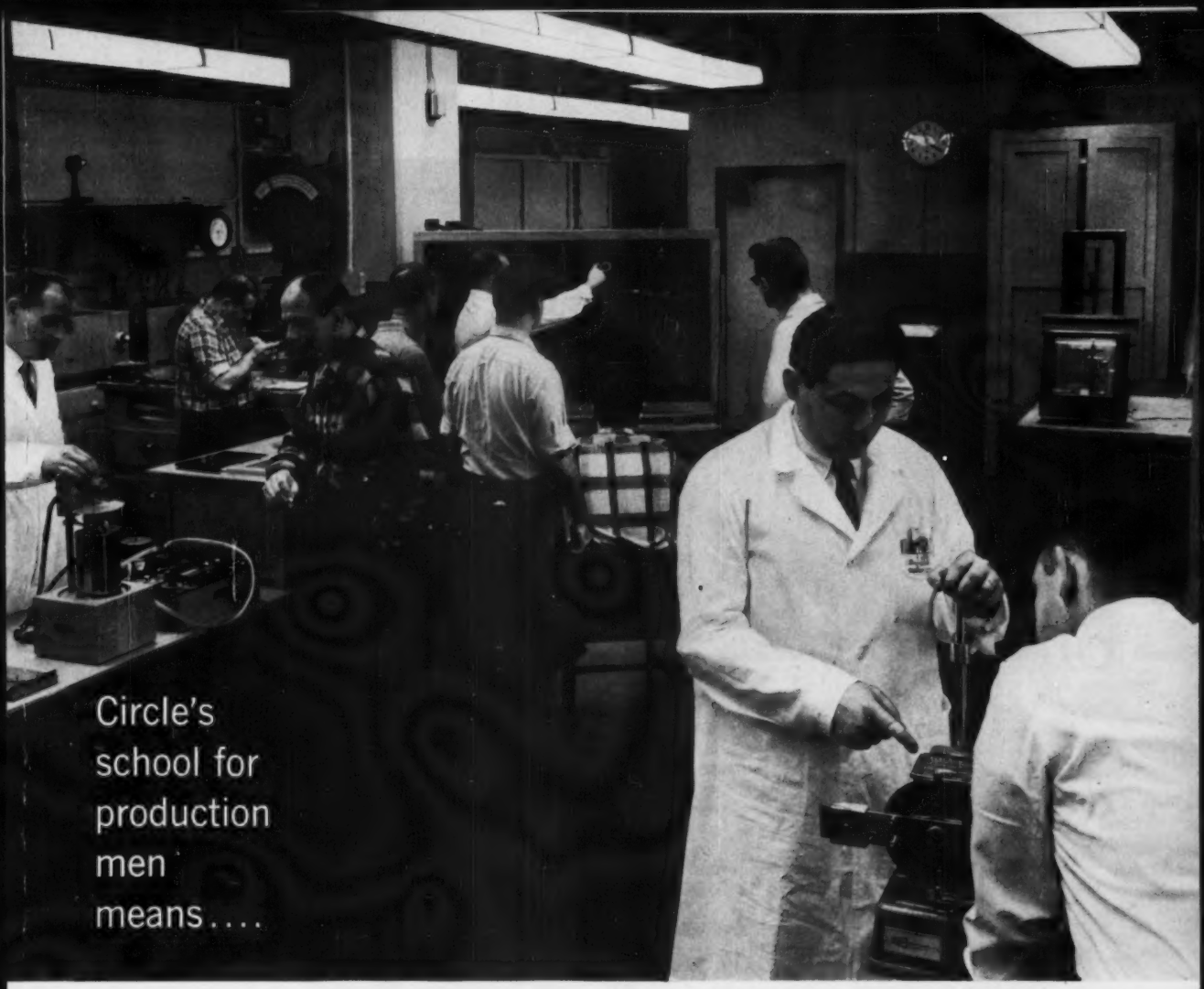
An imaginary picture of future use of electronic computers for controlled automation of electric power plants was drawn by Thomas R. Jones, president of Daystrom, Inc, when he spoke at a management association luncheon recently. He predicted, "In my dream for the future for the electric power industry, I see great strides," in this connection.

He pointed out that "substantial amounts of money are wasted by keeping obsolete plants spinning just to be thrown on line for peak loads or emergency operation . . . when, through a relatively instantaneous computation, these plants could be shut down and brought back into operation when needed."

His "dream" for the electrical power industry is for every plant in the U.S. to be computer-operated. Also, he envisions that each system or grouping of companies should have a "super-computer" which will tell each computer when to start its own plant spinning. The entire system would be controlled by this super-computer without the intervention of human judgment other than the reading into the computer of economic factors of each generating station.

There would be one, or several,

(*Continued on page* 47)




## BETTER WIRE AND CABLE FOR YOU

It isn't enough to build cable quality in the laboratory. There has to be follow-through in production.

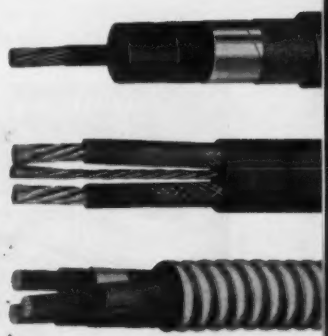
And that calls for production men who not only care enough but *know enough* to consistently turn out top quality products.

That's why Circle production men "go to school." Periodically they attend lectures given by skilled laboratory technicians. They review such subjects as extrusion techniques, proper operating speeds, production line testing procedures, etc.

In-plant training such as this is unusual for wire and cable men. It is one of many reasons, however, why Circle products have achieved a reputation for high quality.

Next time you buy or specify cable, ask for Circle . . . there's no finer cable made.

*Trade Mark



CIRCLE WIRE & CABLE
*a subsidiary of*
CERRO DE PASCO CORPORATION

RUBBER COVERED WIRE & CABLE • VARNISHED CAMBRIC CABLE • PLASTIC INSULATED CABLE • NEOPRENE SHEATHED CABLE • CIRTUBE* EMT

*Developed to meet your needs...*

To satisfy the needs of meter departments who asked for a single transformer to handle loads now measured by 200:5, 400:5, and 600:5 (or 800:5) current transformers, Sangamo has developed this 300/600 amp dual range feature in the BH-6 Current Transformer. Now, the transformer changeouts your crews will have to make are greatly reduced.

This new 300/600 amp transformer has the same physical characteristics as the BH-6 Current Transformers already in wide use. Its body is made of molded epoxy resin, resistor color-coded a bright orange for instant identification. It has an oval shaped window for flexibility in application with the greatest usable opening of any 600 volt current transformer. It's compact . . . the smallest, lightest transformer in its class . . . and, it's easy to mount. It's pre-tested at the factory, and is shipped to you with a certificate of accuracy, ready to be put on the line.

Naturally, its two range feature reduces transformer stocks . . . eliminates need for customer interruption . . . permits "up-scale" demand measurement for better metering accuracy . . . allows initial installation of larger entrance cables . . . eliminates transformer changeouts. And, changing the range of this newest BH-6 transformer, like changing the range on the 200/400 and 400/800 amp BH-6 transformers, is as simple as 1-2-3. First, close the short circuiting link. Second, transfer the secondary lead from the 300 to the 600 amp terminal. Third, open the short circuiting link.

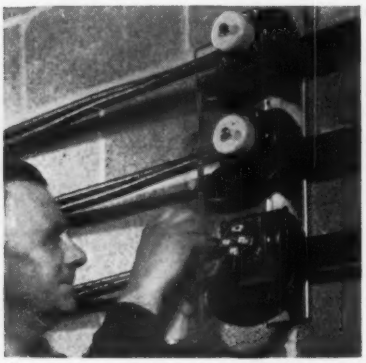
Your Sangamo Representative has complete information on the new BH-6 300/600 amp Current Transformer. Ask him for it . . . soon.

Now, check the pictures below. They show how the flexibility of the new BH-6 300/600 amp Current Transformer can serve you—and your customers—best.

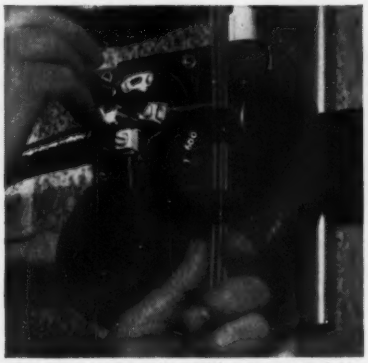
**SANGAMO ELECTRIC COMPANY**
SPRINGFIELD, ILLINOIS

*Lets you standardize on <u>one</u> transformer for all ranges from 15 through 1200 amps.*

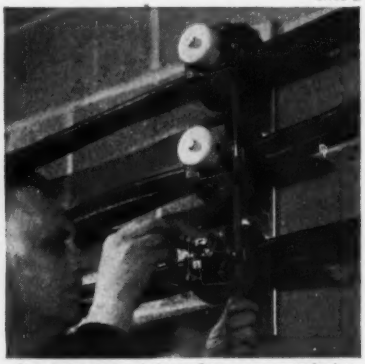
SM60-2



Two turns, transformer secondaries connected on 300 amp range. This results in a 150:5 transformer ratio with overload capabilities to 300 amperes.



Two turns, secondary wiring connected to 600 amp terminal. This results in transformer ratio of 300:5 with overload capabilities to 600 amperes.



One turn through transformer, secondaries connected in 600 amp position. This results in 600:5 transformer ratio with overload capabilities to 1200 amperes.

## Electronic Computer Use

(*Continued from page* 44)

super-super computers which could control the electrical power for the entire nation, switching power from one system to another, as it is needed or as emergency conditions demand.

"Take, for example," Jones said, "the situation which developed when the entire hydro-electric generating plant of the Niagara Mohawk Power Co slid into the Niagara River. A super-computer would have instantly cut that plant out of the line, would have thrown all necessary circuit breakers and cut in power from some other system, and the customers formerly served by the damaged plant would never have known that anything had gone wrong."

## NEMA Publishes New Standards Guide

The 1960 guide to its standards publications has been made available by National Electrical Manufacturers Association. It is suggested that the guide be used in conjunction with the regular price list of standards. The 18-page booklet contains descriptions of all existing standards, including twenty new books produced last year.

Titles of some of these new publications, all of which deal with equipment never before covered by NEMA standards are: Adsorption Equipment; Bituminized-Fibre Conduits and Fittings; Compression-Type Pressure Connectors; Screw-Type Pressure Connectors; Quick Connect Terminals; Installation of Vertical Hydraulic-Turbine-Driven Generators; Electric House Heating Equipment; High Temperature Properties of Industrial Laminates; Electrochemical Processing Equipments; Piping Systems for Steam Turbine Generator Units, 15,000 to 33,000 kw; Glass-Fiber-Covered Silicone-Treated Rectangular and Square Magnet Wire; Round Magnet Wire — Polyurethane-Coated, Vinyl Acetal Nylon-Coated, and Vinyl Acetal Self-Bonding; and Returnable Reel Dimensions for Wires and Cables.

(*More News of Manufacturers, p* 48)

Carlon plastic conduit entirely eliminates common conduit problems; corrosion, leaky joints and absorption through the conduit wall. It installs in a fraction of the time required for many materials. Material costs are low, too.

Now there's a plastic conduit available for many of your conduit applications.

***ECONOLITE***

Designed for either direct burial or concrete encasement. Available in 30 foot lengths.

***PV-DUIT***

Non-corrosive . . . perfect for corrosive applications, industrial and underground use.

***Mail this coupon to get the facts on Carlon Plastic Conduit now.***

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☐ Send me complete information at once.
☐ Have local sales engineer see me regarding Carlon Plastic Conduit.

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Company _____
Address_____
City_____ State_____

World's largest producer of extruded plastics and fittings.

**A TREE TRIMMING PROBLEM SOLVED**

***By spinning this three conductor cable . . . .***

The utility company that installed the distribution line in this photo had permission to go through this forest of great old evergreens, if they did not cut, trim, or damage the trees. After investigating all types of line construction they found that field spun cable was the best solution to their problem. Using cable and spinning it in the field, they were able to put up this three conductor distribution line to everyone's satisfaction, *at a cost less than any other type construction.* For information on field spun cable, write to address below.

CABLE SPINNING EQUIPMENT CO.

3100 Topeka Avenue Topeka, Kansas


## System Designed for Use With Honeywell's '800'

Minneapolis-Honeywell's Datamatic Division has developed a simplified technique for automatically preparing electronic data-processing programs. It is described by M-H as "a breakthrough in programming cost reduction."

Called "FACT" (Fully Automatic Compiling Technique), the system is designed for use with the Honeywell 800 all-transistorized data-processing system. Walter W. Finke, Datamatic president, explains the system in effect eliminates manual program coding by enabling the computer to translate simple statements in English into its own detailed machine instructions. It can be applied to all typical functions of business data processing, including input card reading and editing, creation of data files, data sorting, arithmetic computations, updating of data files and generation of printed or punched reports based on input data, file data or program results.

Finke added that FACT will make it possible to write and check out programs five to ten times faster than by previous manual techniques.

## Britain's Little Barford 'B' Uses Electronic Control

The new British 120-Mw power station, Little Barford "B" features an electronic control system by Evershed & Vignoles Ltd.

Variables, including steam pressure and temperature, water and steam flow, are measured by a transducer. Transmitters at the sampling points send the electric signals by telephone-type cable to the operating room. In some cases, several signals are applied to a beam-balance computer, the output from which follows a predetermined law.

Example of this is that the computer for controlling the induced draft fan hydraulic coupling receives signals proportional to total mill-fuel input and boiler-combustion-chamber pressure. The computer output automatically applies the necessary corrections to the hydraulic coupling. Operating force at the coupling is achieved by applying current to the magnet of an oil-jet hydraulic actuator.

## Plastic Coatings Extend Condenser Water Box Life

There is growing evidence, says Allis-Chalmers, that plastic coatings will contribute to longer condenser water box life. The company is using an experimental $\frac{1}{16}$-in. epoxy-resin coating on the interior of a fabricated steel water box for Ohio Power Co's 18,000-sq-ft surface condenser for the new 450-Mw Unit 5 at the Philip Sporn plant. The welded tube condenser will serve a boiler feed pump turbine.

Other water boxes for A-C condensers are being similarly treated for protection against corrosion. The coating is brushed on by hand.

## Consent Decree Filed

A consent decree filed in the United States District Court in Chicago permanently enjoins ESCO Mfg Co and its agents from: infringing on G & W Electric Specialty Co's copyrights; unfair competition with G & W Electric Specialty Co in any manner by use of advertising material, books and literature containing information taken from G & W Electric Specialty Co's copyrighted books; and further using in any manner or delivering and placing upon the market and in the flow of commerce the book entitled "ESCO Load Break Oil Switches."

## *MANUFACTURERS BRIEFS*

**General Electric** will add a two-story, 30,000-sq-ft chemical and metallurgical lab to its Vallecitos atomic laboratory at a cost of over $1 million. The structure will provide backup facilities for the radioactive materials laboratory there, and permit special studies in the nuclear field. Construction is scheduled to start at once, with completion expected by next fall . . . **Precision Magnetic Controls, Inc,** changes name to Precision Multiple Controls, Inc . . . All the electrical drives for a new U.S.-equipped 50,000-spindle textile mill in Russia will be supplied by **Westinghouse Electric** under a $1-million contract just awarded.

(*More Procurement & Products, p* 50)

OWNERS AGREE: A '60 CHEVY IS WORTH MORE BECAUSE IT WORKS MORE!

# "THIS '60 CHEVY MAKES EVERYTHING EASIER FOR US—IT'S THE BEST RIDING AND HANDLING TRUCK WE'VE EVER USED!"

Walter Otto, Watertown, Wisconsin, contractor, uses a 1960 Chevrolet Fleetside pickup for a big trucking job. Off the road most of the time on rough terrain at building sites, the truck hauls cement blocks, bricks, concrete, insulation—everything it takes to build a house. "This '60 Chevy does everything for us," Mr. Otto says, "and makes everything easier. It's the best riding and handling truck we've ever used—a lot smoother on the bumps. You're not bounced all over the seat like you are in other trucks. And the big body carries a lot of building supplies, saves trips. The cab's roomier, too. You don't feel all crowded in like you do in other trucks."

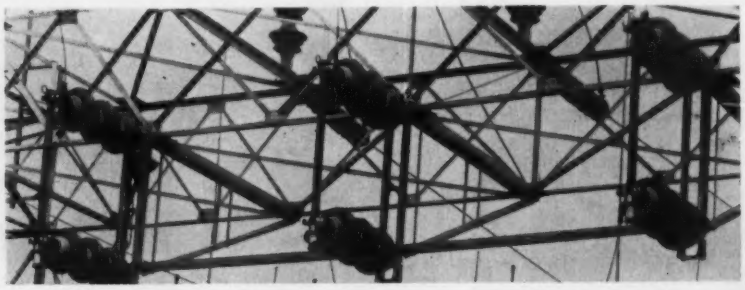
■ They're speaking right up, these owners of '60 Chevrolets, talking about a new truck-and-tire-saving ride that leads to shorter trip times, too. Chevy's independently suspended front wheels step right over bumps, virtually eliminate most of the severe impacts that can wear out trucks and tires before their time. You profit by a big savings on maintenance; get a bigger daily work output because these trucks float you over rough roads with fewer slow-downs. New Chevy cabs are built to last longer, boost driver efficiency. There's more leg room, head room and hip room than ever before, new visibility that's greater by more than 26%, new foam-padded seat, new tougher construction features—double-panel roof, box-section door pillars and many more. Efficient power that knows the most about saving money. The standard 235-cu.-in. Thriftmaster 6, for example, America's most widely used truck engine with 135 h.p. and dollar-saving components. Or efficient short-stroke V8 power, optional at extra cost. Look into it for yourself; Chevy's totally new working ability is at your dealer's right now. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

## 1960 CHEVROLET STURDI-BILT TRUCKS

CHEVROLET

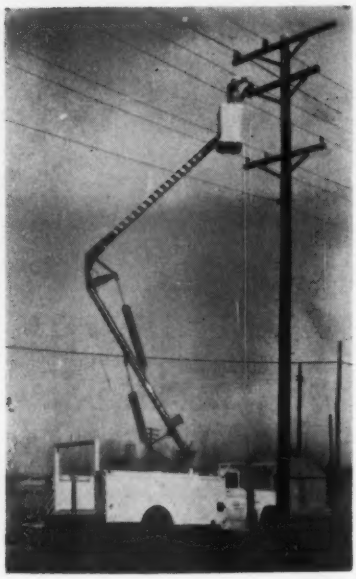
(For further information refer to Readers Service on page 54)

## Power Fuse . . .



**. . . has large-diameter bore** to relieve pressures from high faults. The SMD-2B line is rated up to two million kva (3-phase symmetrical) at 138 kv. The boric acid interrupting chamber for 34.5 to 69-kv ratings has an expellable bore which is ejected at high faults to provide large-diameter chamber. At low and medium faults this liner remains; the small bore helps extinguish the arc quickly. The 115 to 138-kv ratings have stepped bores to provide large-diameter lower ends for high faults and small diameters at the upper ends for low faults, without expellable liners. These fuses are of the solid-material, drop-out type.

**S&C Electric Co, 4435 N Ravenswood Ave, Chicago, Ill.**

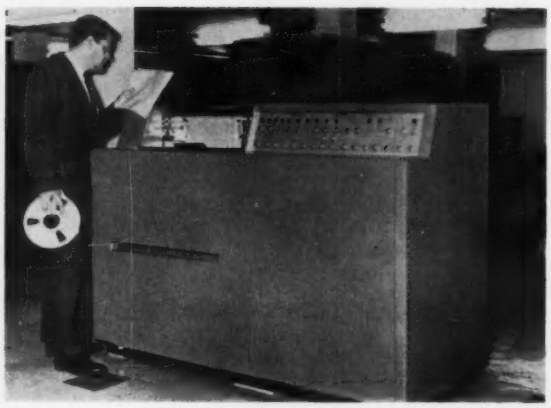


## Aerial Beam . . .

**. . . is insulated in excess of 50 kv.** The series ABS Sky-Master has a maximum ground-to-basket height of 42 ft and is available with either one or two baskets, furnished with or without access openings. The outer beam is a resin-bonded fiberglass tube. The work basket is of reinforced plastic with no current-carrying parts or projections. Dielectric, reinforced plastic rods are installed in the control linkage. The outer beam swings through 270 deg, the inner through 110, and the mast turns continuously in either direction. This enables the operator to position his basket in all directions from the truck. Safety devices prevent unwanted movement when controls are in neutral or if the hydraulic system suffers damage.

**McCabe-Powers Body Co, 5900 N Broadway, St. Louis 15, Mo.**

## High-Speed Printer . . .



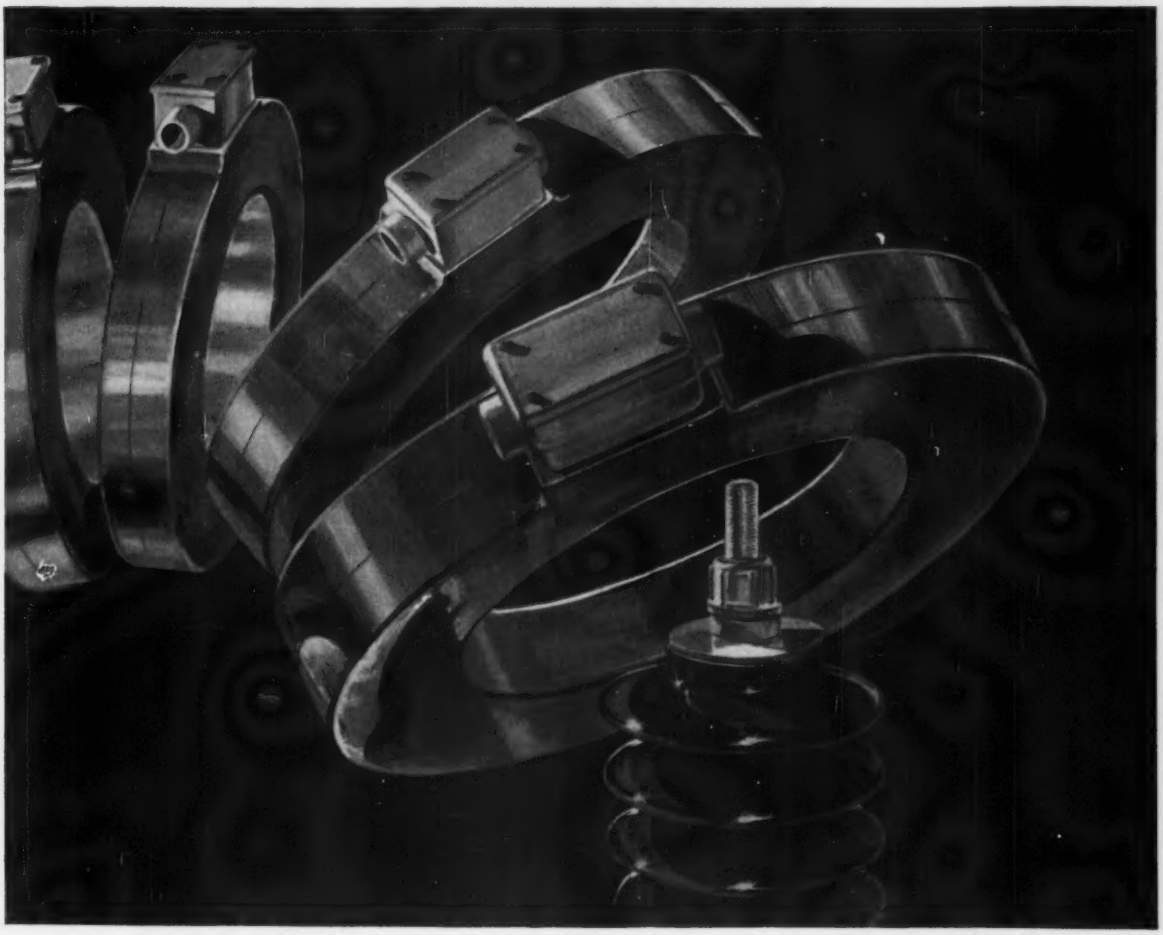
**. . . operates with tape-fed computer systems** of other manufacturers as well as Univac. It functions on the "off-line" principle: the computer is free for other work while printing is done. The Univac Compatible prints entire lines at 600 lines per min. It reads, checks and prints in any desired format data from the computer's magnetic tape. A tape recorder, control unit and printer comprise the equipment.

**Remington Rand Div, Sperry Rand Corp, 315 Park Ave, New York 10, N. Y.**

(*More New Equipment on page* 52)

# ALLIS-CHALMERS

A-1300



*Versaformer* is an Allis-Chalmers trademark.

## New Versaformer current transformer

# installs as easily as tossing rings

**Cuts installation time from days to minutes!** New *Versaformer* current transformer, for indicating, relaying and protective functions, eliminates untanking and bushing removal with circuit breakers and power transformers. Ends the need for large installation crews and equipment.

Epoxy-resin encased *Versaformer* unit is completely weatherproof! Resistant to salt or acid atmosphere. Never needs painting. The complete *Versaformer* current transformer package includes a junction box for immediate conduit hook-up. Sizes: from 400/5 through 1200/5 amps. (Relaying accuracy: 10L200 for 400/5-amp rating.)

› Get all the facts fast! Contact your nearby A-C office or **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wis.

**Hook up new Versaformer current transformer without removing power transformer or circuit breaker bushings or covers. Available in 12, 16 and 20-inch inside diameters; rugged epoxy-resin case withstands wide temperature variations, severe mechanical shocks.**

# DIGS HOLES SETS POLES

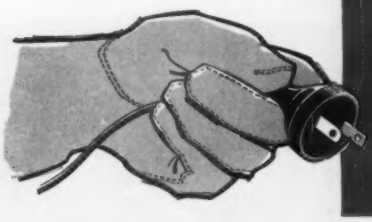
plus

PORTABLE POWER FOR ACCESSORIES AND TOOLS

**Highway's Heavy-Duty "HC" Digger—Blue Ox-mounted with added working features**

The Highway "HC" earth-boring machine can be easily mounted on the "Blue Ox" vehicle or heavy-duty truck. The compact unit connects to the transfer case with a single drive shaft. Easily available controls allow one-man operation. Highway's exclusive telescoping derrick enables 75′ poles to be set. The "HC" machine digs holes from 9″ to 36″ in diameter, 20′ deep.

YOUR MOTOR GENERATES 110-120 AC FOR "PLUG-INS"



Now you need not carry special generator units for "on the job" electrical power. Your Highway Generac unit gives you mobile power—mounted under the truck's hood and taking its power directly from the prime mover. This integral electrical generator gives you 110-120 AC current when and where you need it. Its uses are unlimited—see the picture shown for an example. Write for complete information today!

HIGHWAY

UTILITY DIVISION

**HIGHWAY TRAILER COMPANY**

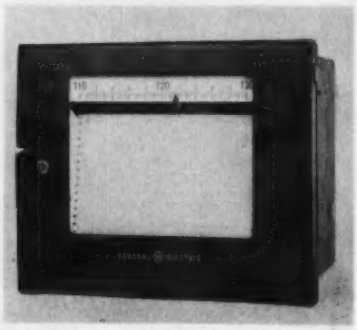
HEADQUARTERS: STOUGHTON, WISCONSIN

Manufacturers of Public Utility Bodies • Earth-Boring Machines • Pole and Cable Reel Trailers • Winches • Power Take-Offs • Service Accessories • Commercial Trailers • Dry-Bulk Haulers • Cargo Containers — Land, Sea and Air

SALES AND SERVICE IN PRINCIPAL CITIES

## Photoelectric Control . . .

**. . . turns street lights on and off automatically.** This Lumatrol model switches 15 amp of incandescent lamp load at 120 v. A similar unit for home use will appear soon.
**Micro Balancing Inc, Garden City Park, N. Y.**



## Voltage Recorder . . .

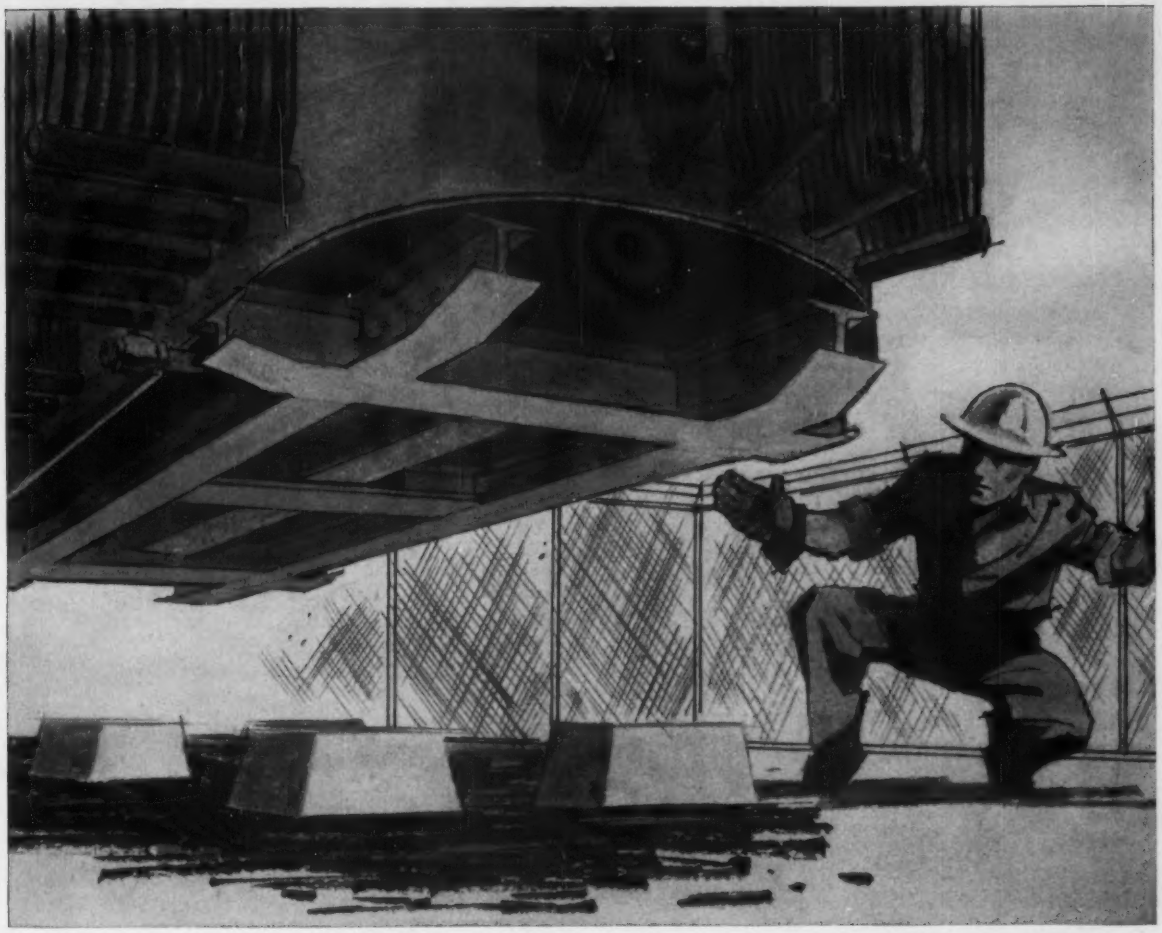
**. . . fills the need for close voltage checks** between 110 and 130 v ac. It makes a continuous record at chart speeds from ½ to 360 in. per hr and response times from one to 24 secs. Ready access and plug-in components ease servicing. Accuracy is within 0.25%. It is available for 50 and 60 cps.
**General Electric Co, Schenectady 5, N. Y.**

## Pocket Receiver . . .

**. . . is high powered and fully transistorized.** This "Handie-Talkie" is available for the standard two-way mobile radio bands—25-54 Mc and

(*Continued on page* 54)

# ALLIS-CHALMERS



# Installs for less on pier, plank or pad

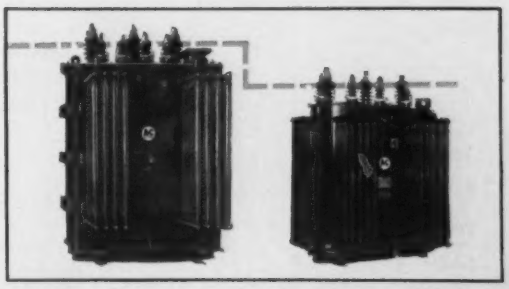
## New Allis-Chalmers small power transformers are lighter, lower by 30%

**Installation charges slashed!** That's the start of the story for these new-design A-C power transformers. Their "hide-away" compactness and lighter weight add up to big savings in handling and pad costs. (The 34.5-kv, 3750-kva transformer, for example, weighs 8000 lb less than its predecessor.)

**New design reduces** losses, exciting current and noise level. Instruments are grouped for operator convenience. Servicing ease is assured by such features as a base sump, which collects and removes contaminants from active oil, and the built-in drain which permits sampling at the very bottom.

*Get the complete story from your nearby Allis-Chalmers office or write* ***Allis-Chalmers,*** *Power Equipment Division, Milwaukee 1, Wisconsin*

A-1238



**New low-profile transformer features include a self-resetting mechanical relief device that automatically resets and reseals after operation . . . and simplified handhole covers with 5 captive "J" bolts instead of 14 nuts to remove for entrance.**

# Readers Service

**For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:**

**NEW EQUIPMENT**

S&C.....Power Fuse ☐
McCabe-Powers.....Aerial Beam ☐
Remington Rand.....Printer ☐
Micro Balancing.....Control ☐
GE.....Voltage Recorder ☐
Motorola.....Pocket Receiver ☐
Commercial Products.....Globe ☐
Keeler & Long.....Paint ☐
Allis-Chalmers.....Trash Rake ☐
Harrington.....Packaged Cranes ☐

**OTHER**

_____

_____

Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countires or to competitive manufacturers.

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FOR:

Reference ..... ☐
Specs ..... ☐
Trial ..... ☐
Purchase ..... ☐

**APRIL 4, 1960**

## Pocket Receiver . . .

(*Continued from page 52*)

144-174 Mc. It weighs just over 10 oz and is carried in the pocket or clipped to the belt. It operates from a rechargeable battery or from replaceable mercury cells.
**Motorola Inc, 4501 W Augusta Blvd, Chicago 51, Ill.**

## Street Light Globe . . .

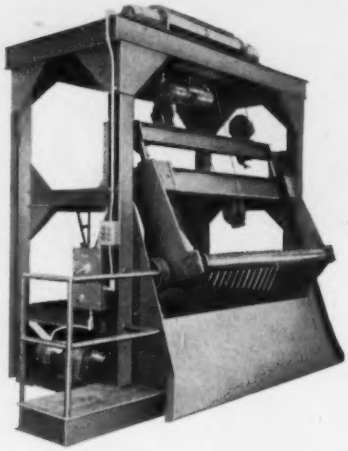
**. . . of an unshatterable design** combines modified polyester resin and chopped fiberglass. It will withstand penetration by objects propelled from less than a 6-ft distance. Rifle bullets will penetrate the globe, but glass fibers tend to reseal the opening and prevent insect entry.
**Commercial Products Div, Plastic Age Sales, Inc, 14300 Davenport Rd, Mint Canyon, Calif.**

## Anti-Corrosive Paint . . .

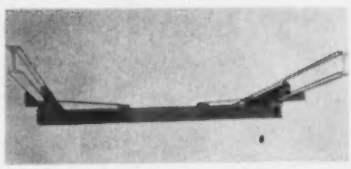
**. . . has high adhesion.** Series 4400 Anodic Self Priming Metal Kolor is applied in one application as a thick 6 to 8-mil coat with the priming and weathering features of two or three coats of conventional paints. Life expectancy is said to be 8 to 15 years.
**Keeler & Long, Inc, Box 1466, Waterbury, Conn.**

## Trash Rack Rake . . .

**. . . frees water intakes of rubbish.** Teeth are retracted when descending with enough space between rack bars and teeth to clear trash resting against the bars. Teeth engage the rack bars on ascent to clean the

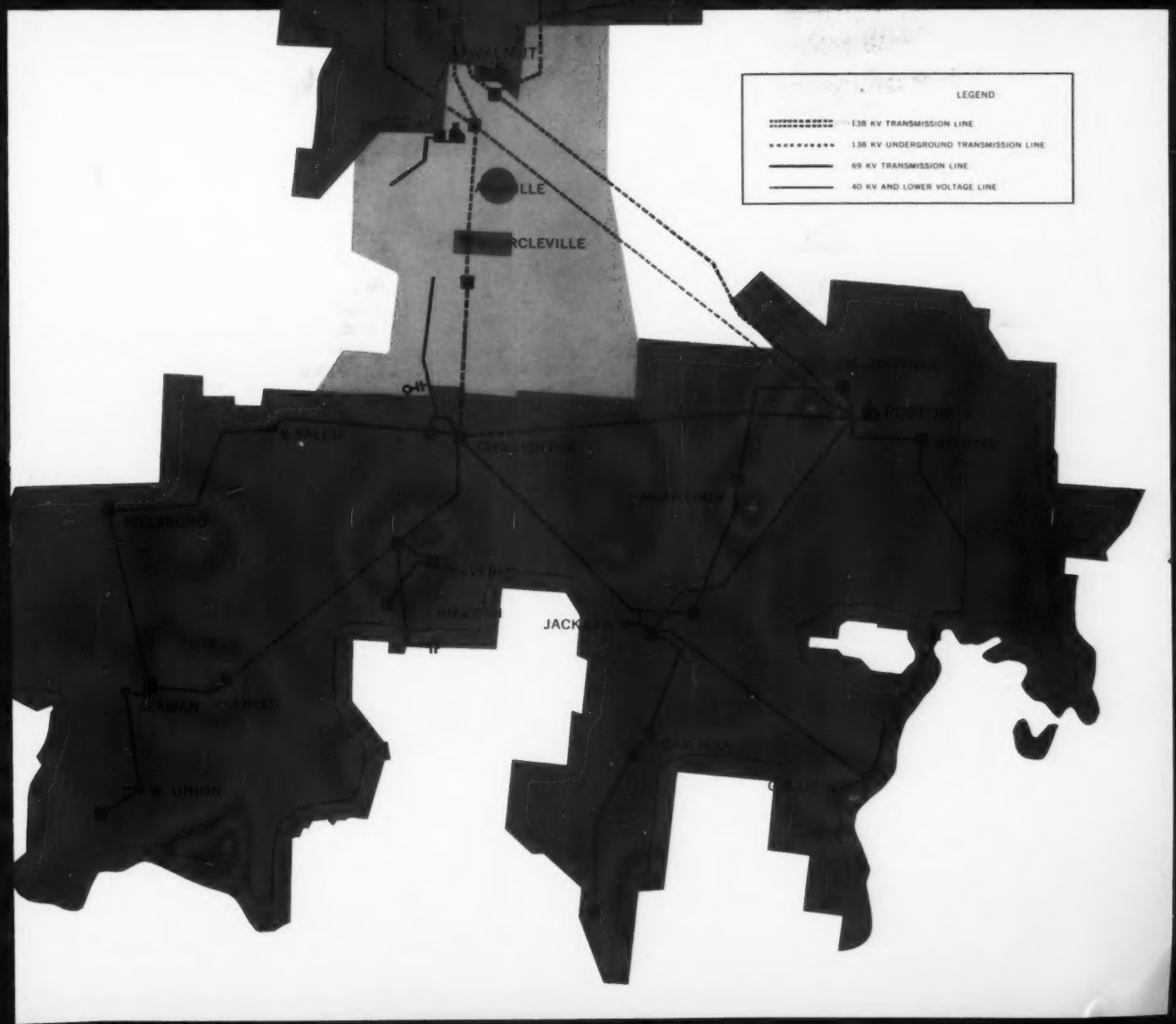


trash which is dumped into a car. Models of the self-dumping log grapple rake are available in 6, 8, 10 and 12-ft sizes.
**Allis-Chalmers Mfg Co, Milwaukee 1, Wis.**



## Packaged Cranes . . .

**. . . to 5-ton capacity** are installed with wrenches only. Top-running or underhung models are shipped complete with all parts except I-beam and drive shaft. The low-cost units are adaptable to various spans and sizes of rails and beams. One and 2-ton capacity models are also available.
**Harrington Co, Plymouth Meeting, Pa.**

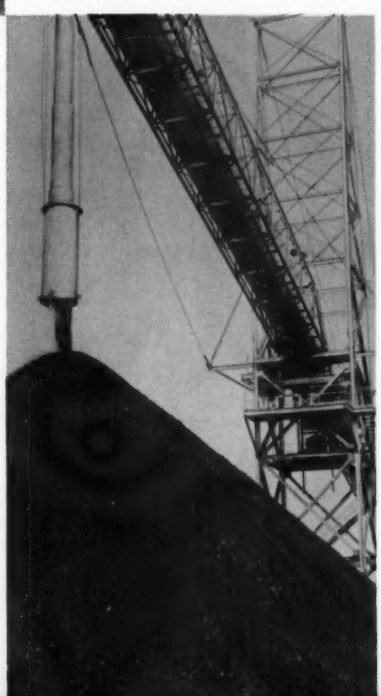

LEGEND
138 KV TRANSMISSION LINE
138 KV UNDERGROUND TRANSMISSION LINE
69 KV TRANSMISSION LINE
40 KV AND LOWER VOLTAGE LINE
RCLEVILLE
POSTON
HILLSBORO
JACK
W. UNION

The $2,700,000 "Coal Chief's" bucket moves 105 tons, 70 cubic yards at each scoop. As high as a 12-story building, shovel's total weight is 2895 tons.

The "Coal Chief" in action on approximately 20,000 acres of company-owned coal lands at Conesville . . . its job is to strip overburden prior to mining operations.

Fifty-ton trucks bring coal from the mines to the station over privately-owned and -built roads. Here, coal is ready for two crushing operations and elevation to silos.

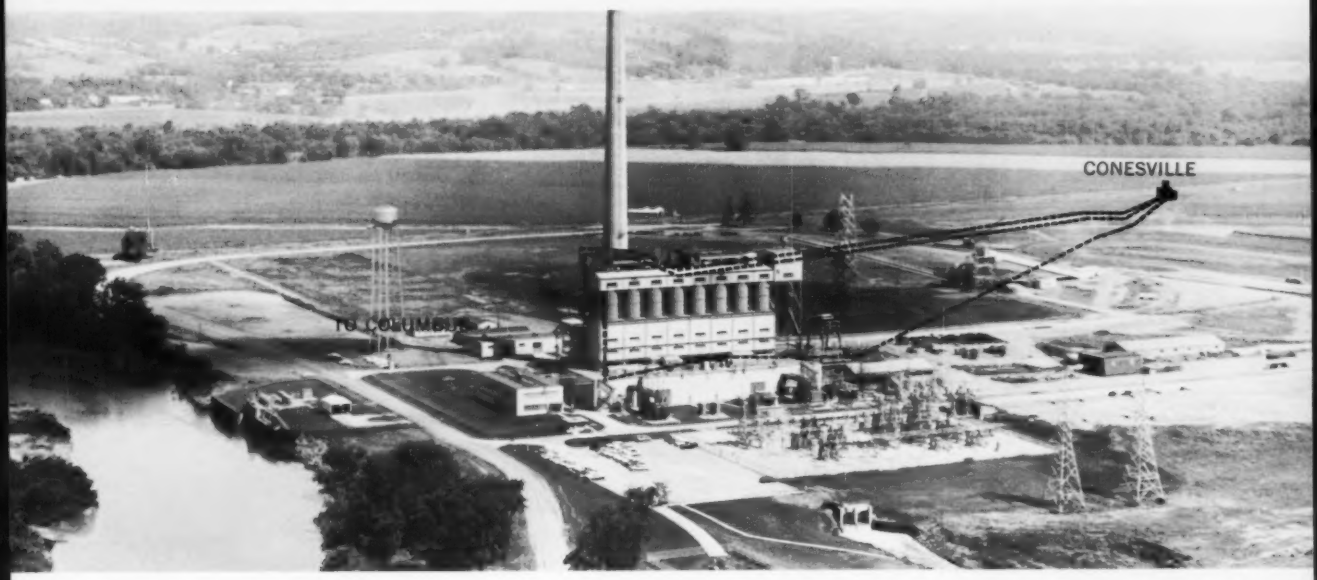
Erection of structural steel early in the life of Columbus and Southern's newest "link with the future" . . . Conesville Station.



Muskingum River provides millions of gallons of its water through this intake.

*Columbus and Southern Ohio Electric Company*

# COMPLETES 130% GROWTH IN GENERATING FACILITIES IN NINE YEARS




## *Westinghouse helps utility to boost system capacity with new 125-mw unit at Conesville*

Unit No. 1 at new Conesville Station, 65 miles east of Columbus, has recently been placed in service, climaxing Columbus and Southern Ohio Electric Company's 14-year expansion program. Addition of this 125 mw of generation brings total system investment to over a quarter billion dollars.

Situated between the Muskingum River and a massive supply of coal, Conesville now transmits power at 138 kv to the northern portion of Columbus and Southern's service area. The economics of high availability of fuel and water largely dictated the location of this station.

Today, the company serves 269,000 customers throughout 6,200 square miles in 23 central and southern Ohio counties. Conesville Station becomes the fourth chapter in a story of rapid load increase, springing mainly from the phenomenal postwar growth of the city of Columbus. The metropolitan area has doubled since 1950; population has risen 26%. Columbus claims the largest percentage increase in value of building permits in the U.S. in 1958. Significant to the rising power demand is greatly increased use of electric space heating. Columbus and Southern's new office building, one of the largest to be built in Columbus in a quarter century, is cooled and heated by the world's largest air-source electric heat pump. Average residential usage has risen nearly 125% in the last 10 years. Representative of industrial growth is the construction of plants in 25 industries throughout the service area in 1958. New suburban shopping centers, new office buildings are visible evidence of a sharp rise in commercial load, too. Today, 70% of company power output is consumed within a 25-mile radius of Columbus.

Total impact of load growth has meant that 74% of the Columbus and Southern system's capacity has been in service less than 10 years. System expansion includes stepping up transmission voltages, building new lines; the total in service to date is 5000 miles.

## *Westinghouse Coordinated Project Planning service combines experience with advanced thinking to assure efficient station installation*

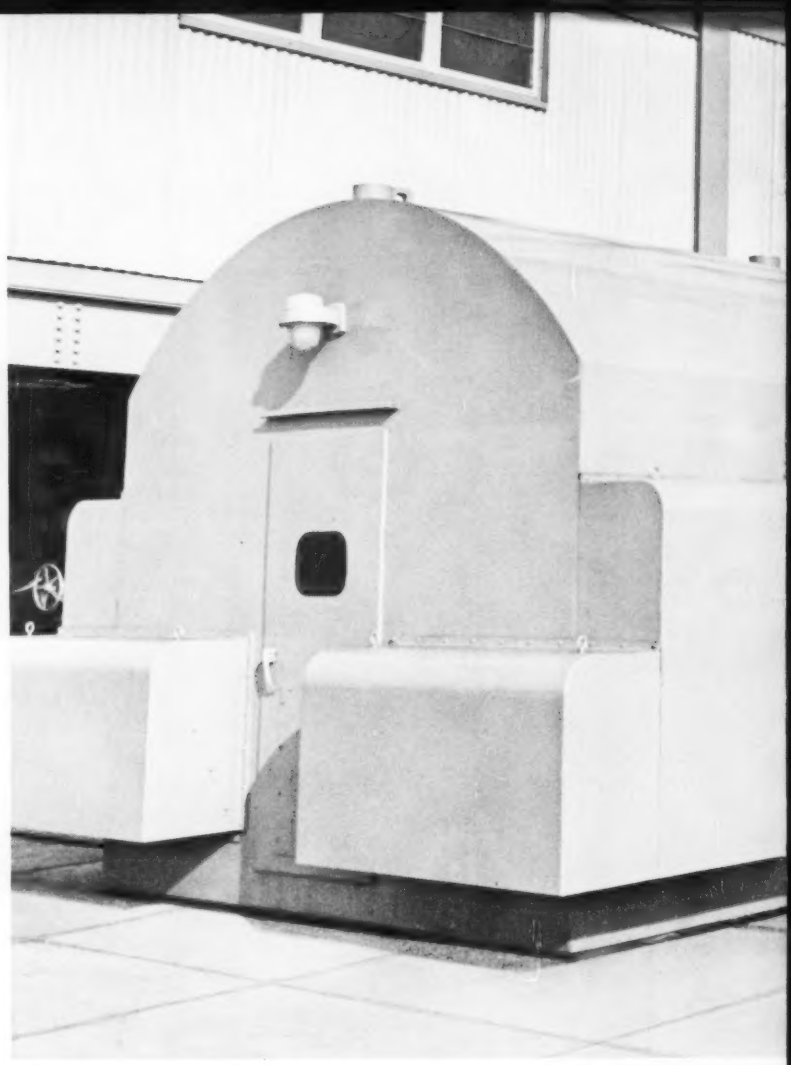
In cooperation with the utility and its project consultant, Ebasco Services, Inc., Westinghouse Coordinated Project Planning service started to work for Columbus and Southern in 1956.

Station analysis; section, manufacture and delivery of apparatus; erection and start-up of station were all coordinated in one timetable. Over the four-year period, a network of communications at Westinghouse brought the newest in team coordination, as well as the latest techniques for applying component equipment to the station. Greatly improved selection and scheduling procedures, made possible through group cooperation, assured meeting the customer's installation requirements. An effective, efficient Westinghouse field service team worked closely with installation and start-up.

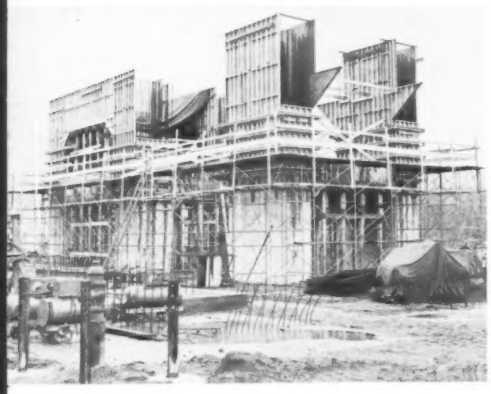
YOU CAN BE SURE...IF IT'S **Westinghouse**

*Westinghouse turbine makes initial*

# FIVE-WEEK EMERGENCY RUN WITHOUT ADJUSTMENT OR SHUTDOWN



Routine start-up of Conesville's Unit No. 1, normally of short duration, developed into an emergency run requiring 24-hour rated output. At the end of five weeks' continuous operation, the unit was voluntarily shut down. Inspection disclosed that perfect initial adjustment had made possible an impressive trial run. Here is an example of the value of the Westinghouse practice of precise factory balancing of turbine and generator rotors under actual operating speeds and temperatures . . . minimizing field work and speeding up the Conesville installation.



Forms and reinforcing steel prepared for the pouring of concrete, providing a 35-foot-high pedestal for the Westinghouse turbine-generator.

An engineer of Townsend and Bottum, Inc., general contractor in charge of construction of the plant, devised an ingenious hoisting rig for the generator, eliminating the problem presented by this high foundation.

Conesville Unit No. 1 consists of a 3600-rpm, 125,000-kw tandem-compound, double-flow turbine ahead of a 160,000-kva, 13,800-volt generator. The turbine is designed for 1450 psig, 1000° FTT, with reheat to 1000° FTT.

Here are a few design features of the Westinghouse high-pressure turbine that will assure long and reliable equipment life . . . minimize thermal stress under both usual and unusual operating conditions: Double casing construction . . . no steam at throttle pressure contacts the outer casing. Nozzle chambers are separate from inner casing . . . each is free to expand independently of all other components. With two throttle valves and two steam chests, each throttle valve can be tested through full stroke while carrying 80% of capability.

Over 10 million kva of operating Inner-Cooled Westinghouse generators attest the simplest yet most reliable method of generator cooling ever devised. Hydrogen is circulated inside the rotor and stator windings in intimate contact with conductors, dissipating heat. Thermalastic® insulation—an exclusive, mica-structured insulation system—permits expansion and contraction of windings without being deformed itself, thus providing like-new protection during the life of the machine.

Three principles of design . . . hydrogen Inner-Cooling, Thermalastic insulation and simplified frame construction . . . are providing today's most efficient, least-costly-to-own generator units. These same principles are now offering a clear road to capabilities in excess of 600,000 kva . . . providing the lowest available per-kva costs.

YOU CAN BE SURE...IF IT'S Westinghouse

## *Liberal steam zone permits maximum feedwater heating*

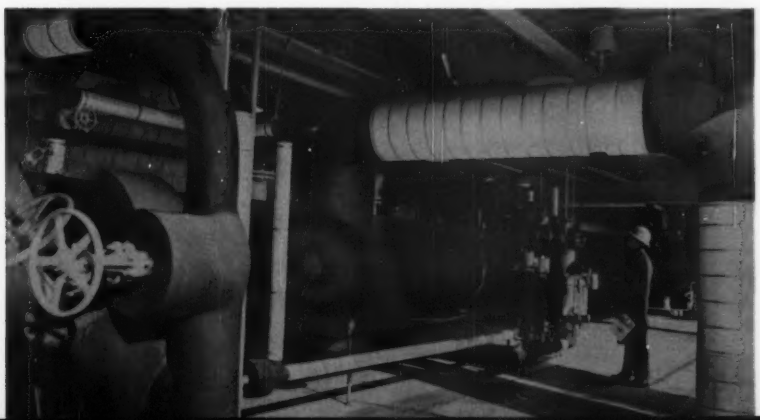
Shown here is the Westinghouse 3960-square-foot horizontal, high-pressure "U" tube feedwater heater. A removable shell type with single-piece cover, this heater features integral drain cooling and desuperheating sections.

Efficient feedwater heating over the full length and breadth of the tube bundle is assured by three work-together design features. First, a liberal steam zone at the top of the bundle and a system of cutaway baffles direct and distribute steam over the full length of the unit. Second, adequate transverse baffling provides uniform distribution of steam to the entire surface of each baffle pass.

Third, support plates insure proper tube spacing—a further guarantee of maximum contact with steam. These plates, forming a rigid bundle structure, serve also to prevent vibration and chafing of tubes and allow free drainage of condensed, extracted steam from the heater shell.

## *High efficiency result of 50 years of design leadership*

Conesville Unit No. 1 condenser is a radial flow two-pass, single-shell design with 75,000 square feet of surface area. Over the last 50 years, Westinghouse, through research and development, has introduced many of the basic condenser designs that today help the electric utility industry to produce low-cost power.



# UP-TO-THE-MINUTE EFFICIENCY

## *for control of station auxiliaries*

A prime example of modern station handling of its light auxiliaries is this bank of Westinghouse motor control centers. Columbus and Southern had asked for a facility which would offer first, efficient control supervision, and second, flexibility for future addition or change-over. A standardized structure, each cubicle to service one motor up to a maximum rating of 200 hp, 600 volts, was recommended.

This single group of control enclosures has been installed away from heavily traveled work areas, reducing accident hazards and providing single-point inspection and operation of motors . . . in short, efficient supervision of controls.

Modular units are uniform in width, depth and height for any given rating. Standardized units are easily added, changed out, or interchanged with one another. Hence, basic flexibility is there whenever needed.

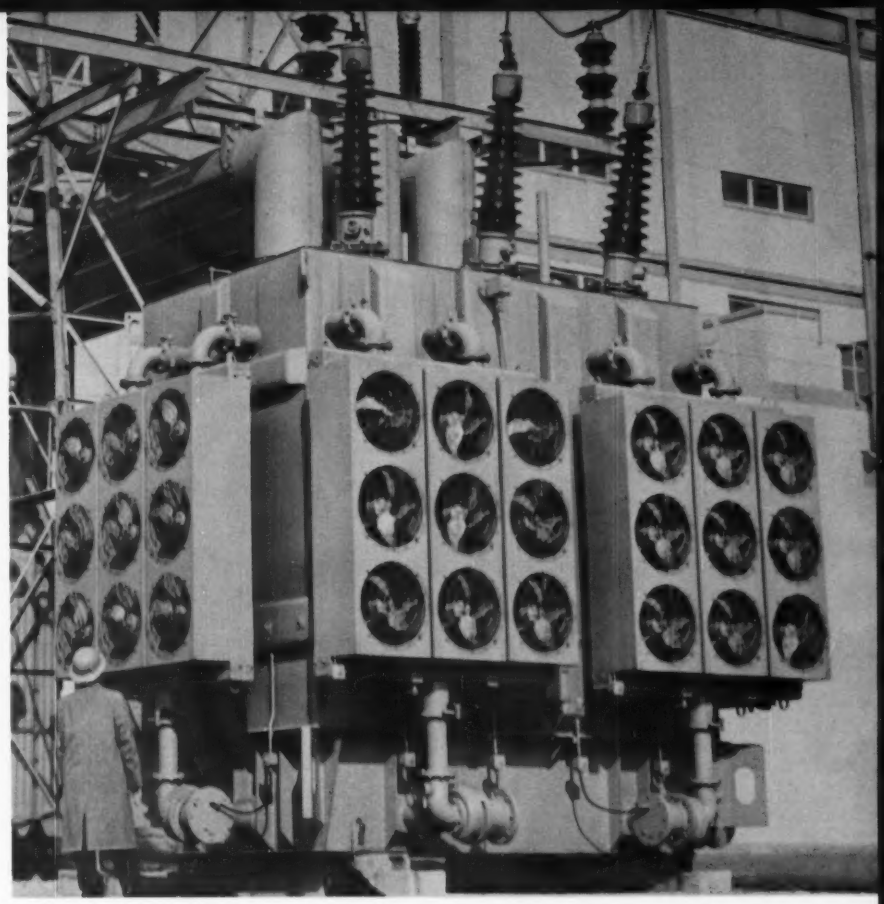
Add to this complete safety to operating personnel during inspection and maintenance. Compartments are isolated by individually interlocked doors and baffles to localize faults. All wiring and parts, including terminal blocks and pilot devices, are front accessible.

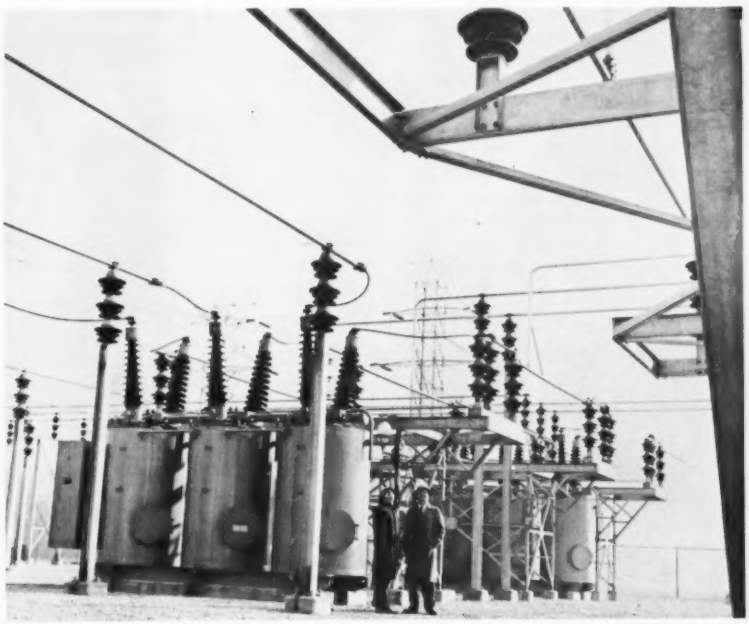
## *Performance and safety versus size and weight*

Conesville's power is transmitted from generator to main power transformer . . . a 150,000-kva Westinghouse FOA unit. Its design employs the work-together principles of "Form-Fit," Shell-Form construction and forced-oil, forced-air cooling. 90,000,000 kva, now in successful use, forecast a long and productive life for this equipment.

Vertically placed, interleaved pancake coils facilitate movement of oil from bottom to top . . . increase transfer of heat from windings to oil . . . improve mechanical as well as dielectric strength. This is Shell-Form construction. A close-fitting tank surrounds core and coil assembly . . . this is Form-Fit design. Forced circulation creates high-volume oil flow and, consequently, maximum exposure of coil to oil. Heat dispersion efficiency of these three ideas reduces amount of oil needed and therefore reduces both size and weight of transformer.

How does the Westinghouse transformer score on safety? Here's just one example of design engineering that leaves nothing to chance. Deterioration of oil, and consequent loss of dielectric strength, is caused by oxidation; acids formed attack windings and insulation . . . eventually cause hot spots and burn-outs. An original Westinghouse principle, Inertaire®, preserves oil, protects the transformer. An atmosphere of dry nitrogen gas is automatically maintained in the space above oil level, excluding oxygen.



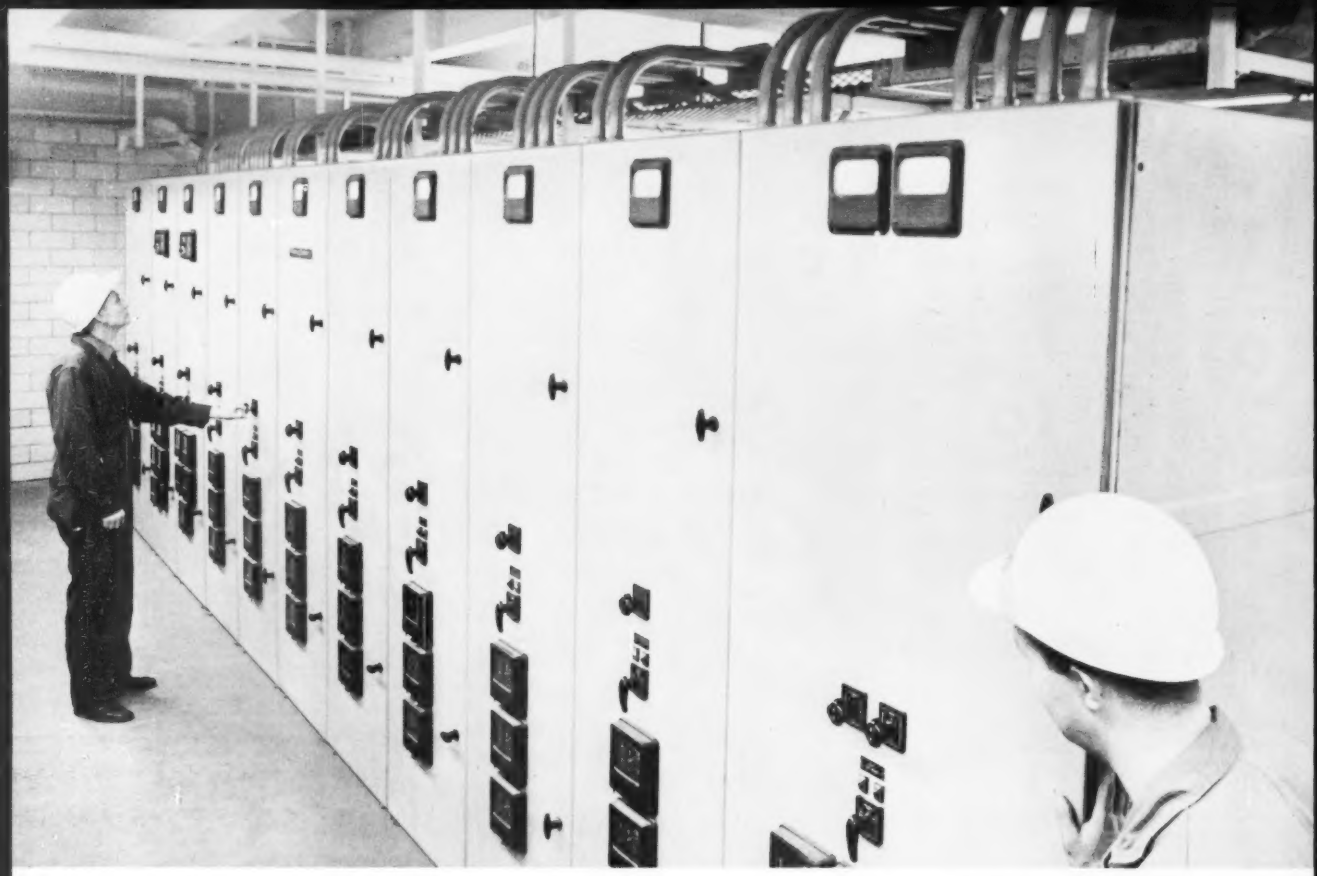


## *Time-proved, service-proved interrupters safeguard capacity of 138-kv breakers*

Multi-flow grid interrupters equip Conesville's four Westinghouse power circuit breakers and are responsible for the efficient, 3-cycle interrupting capability through the full current range to 5000 mva. The units shown here are Type GM-5 3-pole, single-throw, 1200-ampere, electropneumatically operated, mechanically and electrically trip-free.

Still basic to the design of all Westinghouse circuit breakers is the exclusive principle of De-ion® arc extinction. In the long-proved multi-flow design at 138 kv, for example, the De-ion principle assures reliable fault-extinguishing capability to 10,000 mva; in the new tubular grid design at 345 kv, to 25,000 mva; and in the revolutionary $SF_6$ design . . . permitting safe, efficient transmission of large blocks of power.

YOU CAN BE SURE...IF IT'S Westinghouse



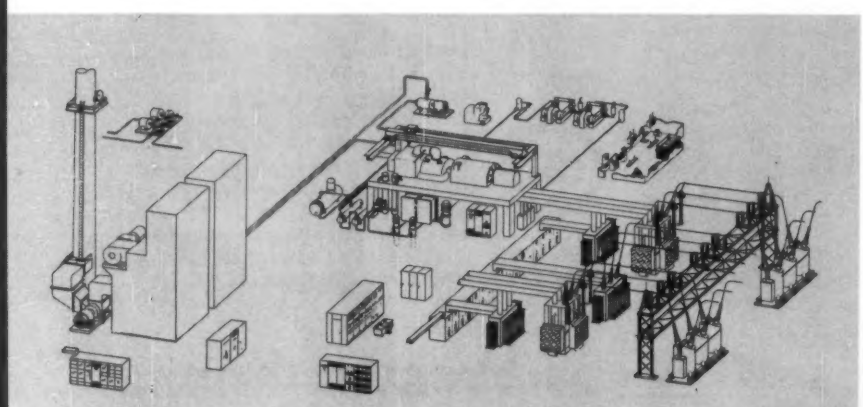
# STANDARDIZED METAL-CLAD SWITCHGEAR

## *contributes high reliability, easy maintenance to station economy*

Westinghouse heavy-duty metal-clad switchgear protects circuits for boiler feed pumps, forced-draft fans, circulating water pumps and other plant auxiliaries. Incoming circuits from a 10,000-kva transformer enter the switchgear through overhead metal-clad bus. Drawout Type 50-DH-250 air breakers interrupt 250 mva at 4160 volts.

Always a convenience to maintenance personnel, the horizontal drawout Type DH air circuit breakers used in Westinghouse metal-clad switchgear assure quick, simplified withdrawal of breaker elements for interchange, inspection or test. At every stage . . . from fully connected . . . to test . . . to disconnected positions, operators are fully protected. Checking breaker operation or inspection of main contacts at convenient working heights is facilitated by easy removal of interphase barriers and lifting of arc chutes.

Making available new or improved equipment in economical "units," such as this switchgear, is just one of the many services the Westinghouse project team performs. One member of that team, the Sponsor Engineer, brings broad system knowledge to bear on specialized station problems. He works with another member of that team, the local Westinghouse Consulting and Application Engineer, to recommend recent equipment developments that most appropriately answer specific needs. The result is a customized project—engineered-together, work-together apparatus selected from the industry's broadest line of generating equipment . . . the Westinghouse line.



This is an account of how one utility met the challenge of progress and its load demands . . . and how Westinghouse cooperated with engineering, experience and equipment. Your Westinghouse representative can bring you similar assistance. The diagram at left is typical of the coordinated equipment he is prepared to supply.

YOU CAN BE SURE...IF IT'S

**Westinghouse**

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS"
CBS TV ALTERNATE FRIDAYS

CP-1053

LITHO IN

# Utility Annual Report Ad Is Now in 'Vogue'

"An annual report ad in VOGUE?"
"Yes . . . but what a report! Here's a utility that knows how to talk to women."
The Dayton Power and Light Company reports to its owners (more than half of whom are women) in a magazine style that you will enjoy reading. It's a story of serving a million people in prosperous West-Central Ohio with electricity and natural gas. Send for your free copy.
THE DAYTON POWER AND LIGHT COMPANY
DAYTON, OHIO
Please send me a free copy of your 1959 Annual Report . . .
NAME
ADDRESS
CITY ZONE STATE

**THIS AD** merchandising annual report of DP&L ran in the March 15 issue of **Vogue** magazine. Importance of women as potential shareholders sparked the idea

Dayton Power & Light Co has embarked on a revolutionary approach to advertising an annual report.

Usually reserving it for shareholders, leaders of public opinion and company employees, DP&L this year went after an entirely new market—readers of a slick women's magazine. Perusers of the March 15 issue of *Vogue* saw this ad headline, "An annual report ad in Vogue?"

They were further informed that here was a report from "a utility that knows how to talk to women," and that more than half of the owners (shareholders) of the power company are women. A return coupon offered a free copy of the report.

The ad is the first financial or public utility ad in the 67-year history of *Vogue*, which has a circulation of over 400,000.

Why this unusual tack? This year's advertising program derived from recognition by DP&L officials of the importance of women as potential shareholders. The company, therefore, decided to reach them through one of the influential magazines in the women's field, Fred H. Dettmar, Dayton P&L's manager, Public Relations Division, reported.

The company also decided to go for another audience of general readership and had a similar ad in the April 1 issue of *National Geographic*. Dettmar said that this was just as much a pioneering effort as going into *Vogue*.

Dettmar also said that this year's annual report has been completely renovated and has no accounting, engineering, or legal terminology in the text.

Other ads are also being run in *Wall Street Journal, Forbes, Financial World, Public Utilities Fortnightly,* and two Dayton newspapers. Commercials are scheduled on two Dayton TV stations. Even without the *Vogue* and *Geographic* ads, requests for copies of the annual report have already topped the 1,000 mark.

The program leading up to this new, unusual approach was this. For the last three years Dayton Power & Light has merchandised its annual report in what national advertising it did. This was distinguished from the usual type of annual report ad which highlights the report itself and includes a condensed balance sheet.

The program derived from reports of the New York Stock Exchange on the number of new shareholders each year and where they lived.

The first venture was into news magazines as well as the usual financial publications. Over 1,200 coupons were returned. Using different publications, the results were about the same the second year.

## I&M Sets Home Heating Sales Record

The addition of 1,681 electrically heated homes and a sale of 134,516 kw in new electric energy sales to commercial and industrial accounts were sales highlights at Indiana & Michigan Electric Co in 1959. Both figures were new 12-month records for the utility.

Home heating installations were up 423 over 1958 figures, and C&I sales increased 28,500 kw, 26,000 over the previous record of 108,000 kw.

Sales of 49,895 ranges, dryers and water heaters, an increase of 6.5% over 1958, were also recorded. Range sales were up, 10.3%, dryers, 6.8%, but water heaters were down 2.9%.

Other figures reported by I&M

- An increase of 315 kwhr in average residential customer's annual consumption, and a company-wide average of 5,179.
- Fifty-nine heat pump installations, several of which were multiple unit.
- Five electrically heated schools added, bringing the total to 19.

(*More Selling on page* 64)

*Trademark

"Superforms* sure fill the bill for a STANDARDS ENGINEER!"

"Fanner Superformed products meet our standards all along the line . . . *technical superiority, accurate manufacture, uniform quality, dependable performance.*"

More and more Standards Engineers . . . *the men who must find BETTER ways to do things BETTER* . . . are testifying that Superforms meet the highest standards. A-1580A

FANNER Superformed with a "PROTECTIVE TWIST"

**ARMOR RODS . . .** Protect long-span T&D lines at supports

**LINEGUARDS . . .** Protect short-span T&D lines at supports

**PATCH RODS . . .** Repair damaged conductors

**TAP ARMOR . . .** Protects conductor at tapping points

**FANNGRIPS . . .** For dead-ending strands and conductors

**FANNSPLICES . . .** Join two ends of conductor wire

**PLASTIC PRODUCTS . . .** For conductor surface protection

FANNER
The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

## Electric Dishwasher Promotion Kit Developed

"Extra hours for the housewife" is the theme of a new electric dishwasher promotion kit developed by the electric dishwasher section of the National Electrical Manufacturers Assn.

The promotion is designed to concentrate the selling activities of utilities, manufacturers, dealers and builders to boost dishwashers in 1960.

Materials in the kit are: Display streamer saying, "My Electric Dishwasher Gives Me Extra Hours;" consumer folder telling the dishwasher story to housewives; model home folder for builders; newspaper supplement; and suggested newspaper ads. All are designed to tie in with other industry electric promotions.

Sumner Rider & Associates, New York, has been commissioned by NEMA to launch a publicity and promotion campaign in newspapers and magazines this year. The agency is presently contacting utilities and co-ops to offer NEMA support in backing up local dishwasher promotions.

For further information: electric dishwasher section, NEMA, 355 Lexington Ave, New York 17, N.Y.

## Westinghouse Extends Heat Pump Sales North

Sales of heat pumps are being expanded into the northern markets by Westinghouse Electric Corp. Previously, heat pumps have been marketed only in areas south of the Mason-Dixon line.

"Now we are going to extend the sale of these units under a selective program to areas where electric rates have been established to encourage the use of electric heating," said Raymond K. Serfass, manager of the company's Air Conditioning Division.

A new Westinghouse distribution policy requires that a utility have an active local promotion program on electric heating, and electric rates which encourage the use of this type of heating.

The decision to go into the northern markets was prompted by recent

(*Continued on page* 66)

OSMOSE
POLE INSPECTORS
DIG
for their
ANSWERS

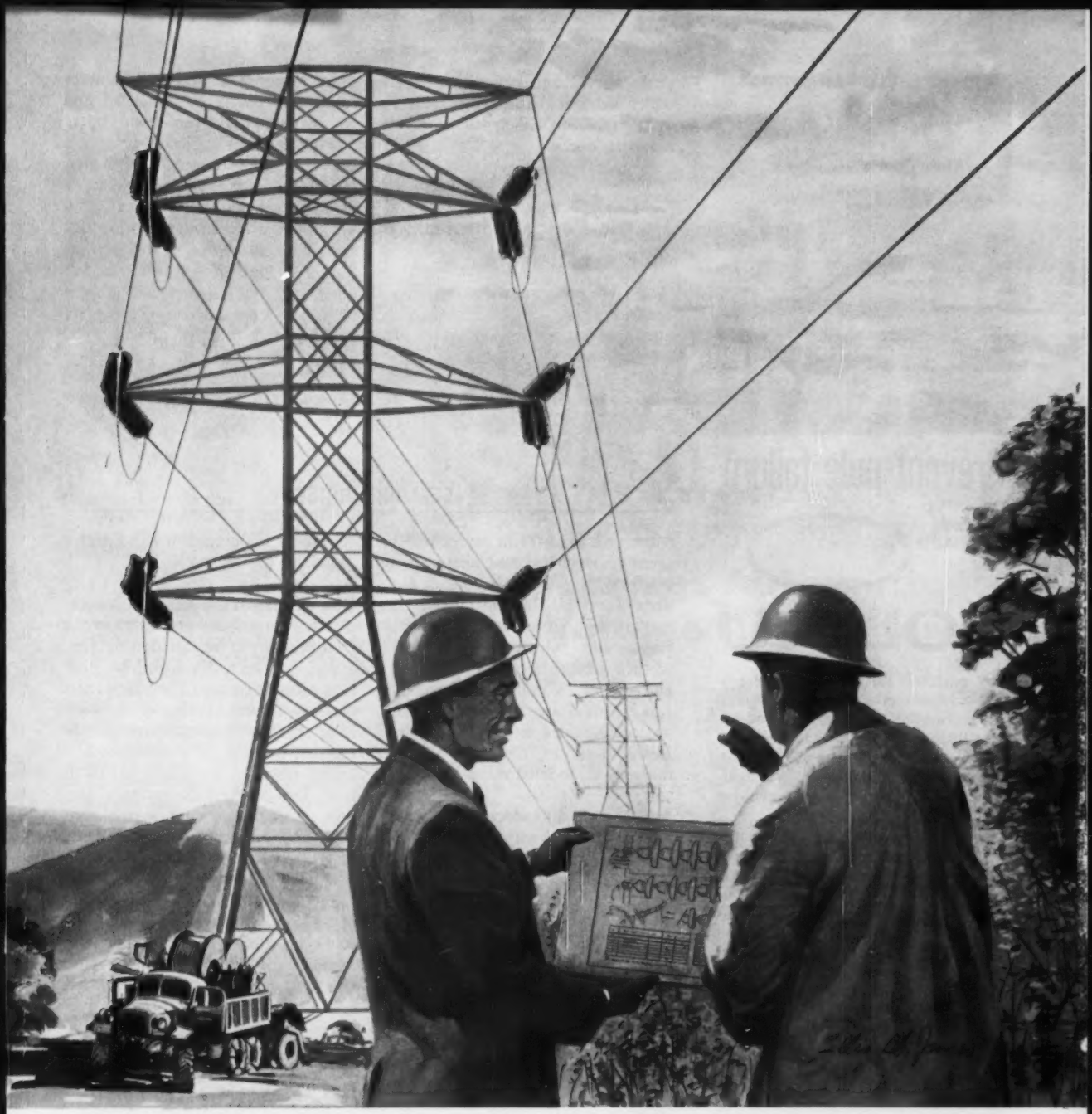
. . . but they don't stop there,
THEY FINISH THE JOB!

Regardless of species or original treatment, every older in-place pole is a prime target for groundline decay. Records prove it. And there's no short cut to inspection. It's literally a case of digging for answers. The first 18 inches will quickly tell the story to experienced OSMOSE Inspectors.

Inspection without treatment merely observes decay as it progresses. Often enough, such methods actually encourage decay. The OSMOSE method not only locates decay, but halts and prevents it. This is the big difference between common "inspection-only" practices and the OSMOSE Inspection and Treatment method.

Hundreds of utilities know that the OSMOSE way is the only sure, safe way to keep older poles standing for many more years of trouble-free service. And the cost is remarkably low. Actual field reports show that the OSMOSE Inspection and Treatment Program can pay for itself if only 3 to 6% of your older poles can be saved from becoming "rejects". Get all the money-saving facts, write: Osmose Wood Preserving Co. of America, Inc., 991 Ellicott St., Buffalo 9, N. Y.

Osmose®
SERVING UTILITIES SINCE 1935



# INTEGRITY

Thirty-two VICTOR No. 924, 25,000 lb. suspensions (EEI-NEMA 52-5) yoked in two strings of sixteen each, carry the strain of this angle tower of Consolidated Edison's Yonkers to Millwood, N. Y. transmission line.

Design that has been proven in thousands of installations . . . quality controlled manufacturing that maintains complete uniformity of product . . . conscientious testing procedures that insure conformance to VICTOR's high standards . . . these are the reasons for VICTOR's enviable reputation for reliability of product and integrity of purpose.

Best evidence of this integrity of purpose is the fact that VICTOR insulators consistently proof-test in excess of their EEI-NEMA ratings. You get more for your money by choosing VICTOR. For catalog, specifications and prices, contact your nearby VICTOR sales office, Victor Insulators Division, I-T-E Circuit Breaker Company, Victor, N. Y.

I-T-E CIRCUIT BREAKER COMPANY

Prevent pole failure

with CHAPMAN®

POL-NU

This patented formulation of Pentachlorophenol was developed for ground-line treatment of standing poles and has these three superior characteristics:

• Grease consistency . . . adheres readily to standing poles; stable to temperature and storage allowing precision machine application.

• Deep penetration . . . assured through use of an oil selected from over 200 tested; oil meets American Wood Preservers' Association specifications.

• Long life . . . through use of Pentachlorophenol preservative of proven stability; Pol-Nu is not water soluble, won't leach out of treated poles.

**POL-NU BANDAGE-MAKER,** designed for use with Pol-Nu, cuts costs and speeds application of ground-line treatment to standing poles.

**POL-NU PAK** is factory-sealed, ready-to-use pole bandage. May be applied instantly by maintenance crews. Easy to stock and handle.

**CHAPMAN CHEMICAL COMPANY**
Leading manufacturer of wood preservatives
MEMPHIS 1, TENNESSEE
*Palo Alto, Cal. • Portland, Ore.*
*Minneapolis • Charlotte, N. C.*

**MAIL COUPON FOR COMPLETE DATA**
Chapman Chemical Company
P. O. Box 138, Memphis 1, Tenn.
Please send your folder, "Preventive Maintenance For Poles," to:
Name_____
Company_____
Address_____

performance and reliability figures which show that the manufacturer's units have been sufficiently proven in northern areas.

## Electric Range Doubles As Room Heater

A Georgia farmer has turned his electric range into a double-duty appliance by figuring out a new use for the timer.

He heats his kitchen on cold winter mornings by setting the timer to come on from 30 minutes to an hour before he wakes up, and by leaving the oven door open.

Middle Georgia Electric Membership Corp, of which the farmer, Harold Stone, Wilcox, Ga., is a member, reports that it takes 2,000 to 4,000 w to heat the average size kitchen. When the oven is turned to "broil," 3,400 w are produced. If the range is a one-oven type, and is needed for breakfast cooking, turn on the surface units instead for heating, the Co-op suggested. Surface units will produce from 5,000 to 7,000 w, it said.

## SELLING BRIEFS

More than $1,500 in prizes will be given to **electrical and heating contractors** in a *Better Homes & Gardens* Electric Heating and Year-round Air Conditioning Contest. Contestants will enter case history of their best sale of electric heating and/or air conditioning between Jan. 1 and June 30, 1960. Contest has been divided into two categories: Installations in new homes, and those in remodeled ones.

Addition of 600 **electrically heated homes** in 1959, with plans for 500-600 more, has been reported by Atlantic City Electric Co. This brings the company total to 2,600. Utility also plans to spend $1 million on all types of sales promotion in 1960.

Benefits and economic advantages of **heating churches** electrically are described in a 4-page booklet produced by Edwin L. Wiegand Co, 7500 Thomas Blvd, Pittsburgh 8, Pa. Some of 200 churches heated electrically throughout the country are illustrated, and equipment use, installation and operating cost of one key installation are listed.

What is reportedly the only complete **remote control** for electric heating systems has been introduced by Markel Electric Products, Inc, Buffalo. Low voltage, remote 2-heat system makes it possible to regulate temperature of all rooms individually and remotely from central control panel. Unit air conditioners can be wired to same power source as heating units, with a single-pole, double-throw selector switch in the heated area.

Remote **air conditioner** that is completely charged and pre-tested at the factory and can be installed through a wall has been developed by Fedders Corp. Termed Flex-Hermetic, the key to the system is an 18-ft length of flexible armor-covered tubing that permits the evaporator coil to be installed as much as 18 ft from the outdoor compressor section. Unit, for which patent has been applied, is 2-hp with capacity of 22,000 Btu.

**Lamp industry sales** were in excess of $425 million last year, according to F. M. Sloan, vice president and manager of Westinghouse Electric Corp's Lamp Division. Total exceeded 1958 by about 14%. A five-year forecast by lamp division economists indicates that by 1964 the total market will be 50% greater than last year at current prices.

**Sodium lamp** giving 100 lumens/w has been developed by AEI Lamp & Light Co England. Reportedly giving 25% more light than any other existing source, the high-efficiency lamp has a straight arc tube formed into a crescent section alternating to opposite sides over short lengths. Directional output of light is approximately ⅓ greater sideways than downwards making it particularly useful for street lighting. Lamp will have 92/lumens/w average, with 88 at 4,000 hours, manufacturer states.

*In the heart of Lake Charles...*

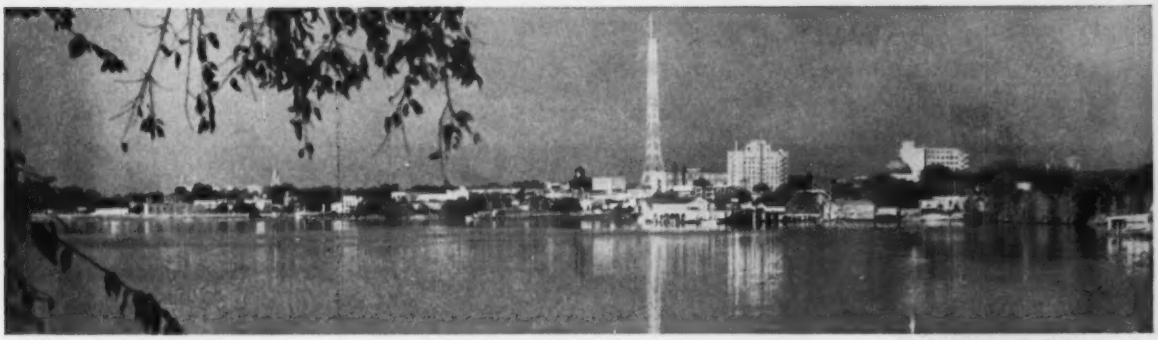


Photo by Rybiski, Lake Charles, Louisiana

Lake Charles, Louisiana ... city on the move. Industrial hub of the Gulf Coast. Major port and center of Louisiana's petroleum industry. Big producer of chemicals. Home of the world's largest rice mill. Good home, too, to 70,000 people.

In Lake Charles, the demand for power grows—steadily, in the long run, but with daily and seasonal demands varying from light to heavy. These fluctuating demands emphasize the importance of automatic voltage regulation to maintain steady voltage under all load conditions. That's why the Gulf States Utilities Company has recently installed a 7500 Kva Wagner Load Tap Changing Power Transformer in the downtown commercial area.

This compact unit utilizes a new design in the load tap changing mechanism, which has been greatly simplified to provide quiet operation and long operating life with extremely little maintenance.

Constant research and development have kept Wagner up front in transformer design for more than 65 years ... made Wagner a leader in power planning. So, remember this:

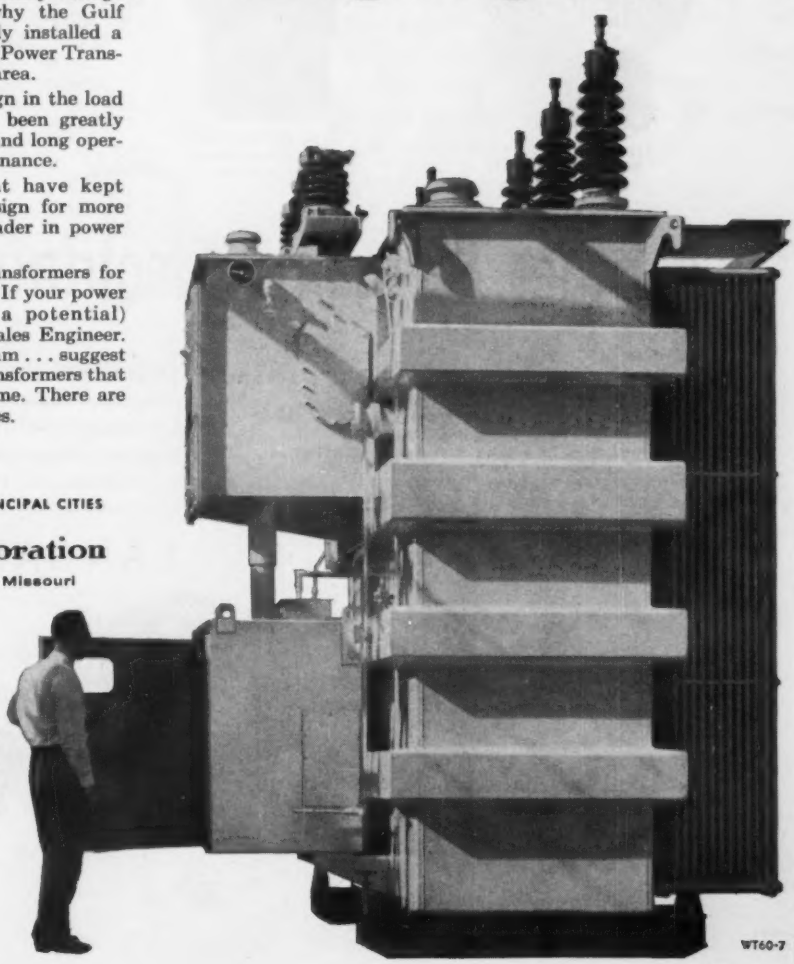
Wagner makes a complete line of transformers for industrial and power company needs. If your power needs present a critical (or even a potential) problem, call your nearby Wagner Sales Engineer. He'll help you plan your power program ... suggest Wagner power and unit substation transformers that will meet your needs for years to come. There are Wagner branches in 32 principal cities.

**BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES**

**Wagner Electric Corporation**

6456 Plymouth Ave., St. Louis 33, Missouri

# This Wagner LTC TRANSFORMER Assures Automatic Voltage Regulation



Wagner magnetic amplifier control equipment senses any voltage fluctuation in the line and automatically regulates the voltage to meet the demand.

LIVE BETTER ELECTRICALLY

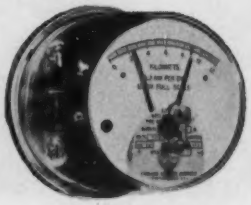
WT60-7

*Why call it "Demand"? Wouldn't you prefer to use one of the terms employed to describe the "demand" function of the Sangamo meters shown here?*

Type KVAR for thermal kvar *"requirements"*

Type LA for polyphase thermal kva *"load peak"* and kwh

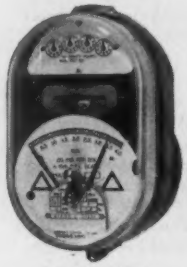
Type J2T for singlephase thermal kw *"use"* and kwh



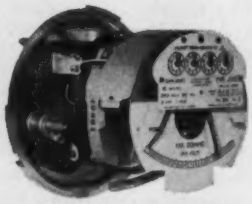
Type WD for thermal kw *"discount value"*

Type PW for polyphase thermal kw *"capacity charge"* and kwh

Type TDT thermal *"load" transmitter* for telemetering



Type LVA for polyphase thermal kva *"capacity"* and kwh



Type J2A for singlephase thermal kva *"load factor"* and kwh

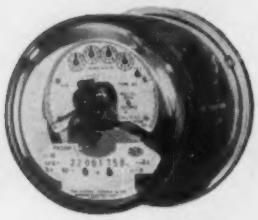
# Another Sangamo Electric report on the

**Regardless of what you call "Demand" measurement, you can depend on Sangamo Meters to do it better...**

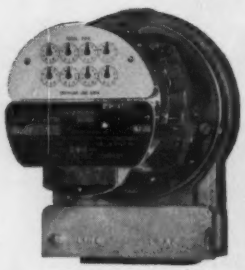
Sangamo offers the most complete line of demand* measuring instruments in the industry... equipment to indicate and record demands from the smallest values to the largest encountered by the electric power industry. The line includes singlephase and polyphase Type D

SANGAMO ELECTRIC

SPRINGFIELD,



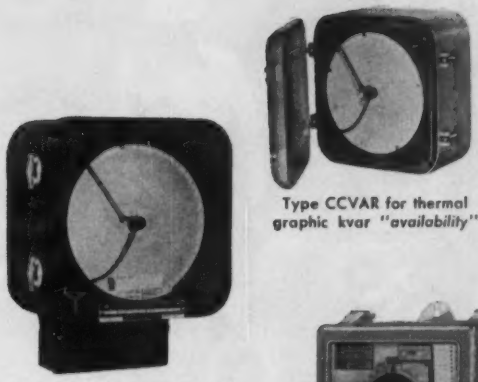
Type P4D for polyphase mechanical kvar *"selected service"* and kvar hours



Type JD differential registers for *"energy factor"* billing

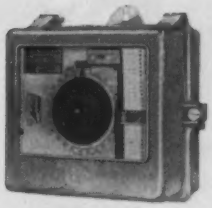
Type P2D for polyphase mechanical kw *"peak use"* and kwh

SM60-1



Type CCVAR for thermal graphic kvar *"availability"*

Type CCW for thermal graphic kw *"integrated peak power"*



Type DDR for digital *"peak load"* recording with punched tape

Automatic translator for DDR punched tape

# use of the word 'Demand' in metering

Several months ago, in these pages, we questioned the use of the word "demand" as it is applied to billing. The point was made that it is time for all of us to reconsider our use of the word, and we asked for your opinions and suggestions about what to do with this industry bogey-man.

Your response to our question was immediate. Answers came from all over the country, Canada, and South America. You were practically unanimous in agreeing with us . . . it is time to take the "demand" out of demand metering, and substitute some less offensive and more easily understood term.

Now, we believe that we have received enough suggestions to give us a representative sample of your feelings, likes and dislikes. We've counted and catalogued these suggestions (note: the most popular terms have been used in the product captions) and have listed the three that were mentioned most often on the ballot you see below. (We've also left space for a write-in vote if you would like to suggest still another term.) Won't you cast a vote for the term you think would do the best job of solving this thorny public relations problem, and mail it to the address shown on the ballot?

mechanical demand registers, Lincoln indicating and graphic demand meters, digital demand recorders and translating systems for Kw, Kvar, and Kva demand. You'll do well to look to Sangamo first for all types of demand measurement instruments.

*Until your vote is cast, and you've selected a new term.

COMPANY
ILLINOIS

Type J2D for singlephase mechanical kw *"power supply"* and kwh

Type P3D for three stator polyphase mechanical kw *"service capacity"* and kwh

## BALLOT

Let's take the "demand" out of demand metering. Vote for the term you feel best describes this phase of metering. Check your choice.

☐ Capacity ☐ Load
☐ Load Peak ☐ _____

Name_____
Position_____
Company_____
Address_____
City & State_____

Clip and mail to:

SANGAMO ELECTRIC COMPANY
MARKET RESEARCH DEPARTMENT
SPRINGFIELD, ILLINOIS

# POWER-INSTALLED SCREW ANCHORS

## average 5 to 8 man-minutes for complete installation

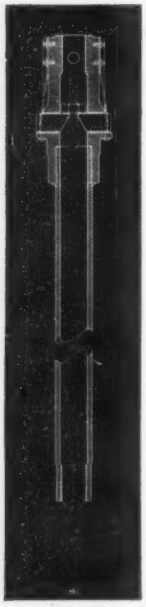
**Latest advance in anchoring technique speeds line construction . . . realizes greater value from investment in hole-boring equipment**

If your company uses power hole-digging equipment for line construction, you can now use that equipment to install the new line of Chance Screw Anchors.

Chance Power-Installed Screw Anchors, ranging from 78 to 176 square inches in area, can be speedily installed in all types of soil, except extremely rocky soil. Your present power boring equipment, regardless of type, can be easily adapted to power anchor installation. Only one new part is needed—the wrench shown below. This wrench transmits torque from the power equipment directly to the specially designed hub on the anchor helix. Since the anchor rod is not subjected to torque, it only has to be heavy enough to support the guy load—a cost-saving factor.

Installation procedure is extremely simple. *Step one* is to remove the Thimbleye or Twineye nut and slide wrench on the anchor. *Step two* is to fasten the wrench to the "Kelly Bar" of the power-digger, or, to fasten the wrench on the pilot bit of the auger using an adapter. *Step three* is to drive the anchor with the power equipment. *Step four* is to release the wrench from the anchor and retrieve it from the ground. (The spring-loaded "dogs" that lock rod in position are easy to release.) *Step five* is simply replacing the Thimbleye on the end of the rod—your anchor is ready for hooking up the guy wire.

These five steps are accomplished in a matter of minutes. Repeated time tests in various types of soil prove that Power-Installed Screw Anchors averaged only 5 to 8 man-minutes for a complete installation *—from the time the equipment was moved into position until the anchor was ready for the guy!*



**THE ONLY PART NEEDED** is this special wrench. (Diagram shows how it fits the anchor.) Wrenches are made to fit all popular makes of earth-borers.

**THIMBLEYE and TWINEYE** guy-wire nuts are available. They distribute pulling stresses uniformly and keep guy wire from spreading, kinking, or bending.

**SHARP CUTTING HELIX** of high strength structural steel is tapered to minimize earth disturbance. Special hub fits lower part of wrench. CA59-23B

### PULL TESTS PROVE HOLDING POWER

During the engineering and development stages of these Power-Installed Anchors, several hundred tests were made to check the anchoring dependability of power-installed screw anchors. Each anchor was pulled by a mobile testing unit to determine maximum holding power. Complete test data is given in Bulletin 868. Address your Bulletin requests to...

**A. B. CHANCE CO.**
CENTRALIA, MISSOURI
A. B. Chance Co. of Canada, Ltd., Toronto

Electric Co-operatives and Companies . . .

# Pool Wits and Push Rural Sales

Report on
Inter-Industry
Cooperation

**In many areas, the co-ops and investor-owned companies** could form a successful alliance. And in some it has already been done, much to the surprise of a few harsh critics. The co-ops and companies have established fruitful common ground in such areas as research in power choring—by far the most important—sales promotion, general load building, and education. All stand to gain through more sales, healthier regional economies, and better mutual understanding.

**In Kansas, for example, on April 29, some 5,000 farmers** are expected to crowd Kansas State University's fieldhouse to attend a feed-handling equipment conference. Their hosts: The state's six electric companies and 36 electric cooperatives. This is just one instance where cooperation has spawned results that couldn't have been achieved in any other fashion. By banding together on farm problems, the Kansas utilities have been able to enlist the valued support of the state university. And by facing the farm equipment dealers as a united front they command better service and sales promotion efforts. Their opposing views of utility ownership may never be reconciled. But both sides feel their mutual efforts have wrought progress that far outweighs the differences involved.

**The record of the Kansas utilities,** though more successful than most, by no means stands alone. In Arkansas, the co-ops and companies sponsor a plan to put modern electric appliances in the kitchens of high school home-economics departments. In Michigan, the utilities work with Michigan State University in producing radio and TV programs that illustrate farm electrical applications. They broadcast their tapes and kinescopes over six radio and four television stations. Some state universities co-sponsor power-choring research with their utilities. In still other states, the utilities come together to sponsor farm youth programs. Much of this activity, all of it inter-industry effort, has been as successful as it has been diverse. About the only note of disappointment is that it hasn't gone far enough. The utilities have only scratched the surface in electrifying farm chores, the most critical need of all.

**Behind these local goings-on, looking toward the future** of the truly mechanized farm, is a fledgling national organization—The Inter-Industry Farm Electric Utilization Council. The I-IFEUC was awarded its unwieldy title back in 1954, the year it was set up to provide national leadership for an all-industry effort to expand and improve farm use of electricity. Since then, it has gone about its task quietly, urging cooperation at grass roots levels. It collects no dues; its sole income comes from the gate receipts at its annual Farm Power Conference. Its local chapters, established in name in 40 states, are active, to one degree or another, in 30. The Kansas council is an example of what can be done.

**The Kansas group, called the Kansas Farm Electrification Council,** was set up in 1954, and functions informally by the common consent of its members. Like the national, it collects no dues, although some state councils do (as much as $100 per year in a few cases). Five directors guide its state-wide activities; two from the co-ops, two from the power companies, and one from Kansas State University extension service. The top officer, Chairman Marion Zink, is treasurer of Minnescah Rural Electric Cooperative Assn, Inc. The vice-chairman is H. S. Hinrichs, Kansas Power & Light Co's Director of Community Service. These key jobs alternate; when Zink steps down as chairman, a company man will take his place for the next term.

**The council meets about eight or nine times a year,** according to Hinrichs. There's no set schedule; at each meeting the board decides where the next one will be held (a different area of the state each time) and what outside group (such as a farm implement manufacturer) they should invite in for their next discussion. At each meeting, all the co-ops and companies in the area are invited.

**Their first joint task was to size-up the state-wide farm appliance market,** both inside and outside the home; something that had never before been done. Each utility surveyed its own area, and the result—a tabulation of rural electric equipment—showed an immediate and surprising $20 million appliance and equipment market to be tapped. All companies and all but two of the co-ops participated; returns from the consumer sample ran to an impressive 94.8%.

**Clothes dryers got first attention**—the survey had shown gas dryers were outselling electric dryers in the country by a disturbing margin. Sales promotion people from the utilities and equipment distributers were invited in to map out the campaign. Their work was rewarded. Dryer sales picked up in rural Kansas while they declined nationally in 1957. The '57 campaign was so successful it was repeated in the Fall of 1958. The second time around, the distributers agreed to pay for all the promotional material.

**Currently, the Kansas Council is promoting space heating,** a carry-over from a year-long promotion in 1959. Each company and co-op does its own advertising, with the co-ops jumping into the theme in early 1959 with a kickoff issue of their own state newspaper carrying five features on space heating. The immediate results were so encouraging that even the lukewarm co-ops (there were three or four) were literally forced into the campaign by their own members' interest. As a consequence, over 1,000 kw of electric heating was installed in rural Kansas last year. An impressive gain, it represented an approximate 30% increase in total electric heat installations in the state, Hinrichs believes.

**A look inside the council's electric heating campaign** reveals the depth to which it penetrates a sales problem. The Council's work goes far beyond the general idea of a sales theme. Their full campaign, set up through joint-effort, includes typical marketing programs, case histories, degree-day charts, lists of dealers that will give technical assistance, scores of reprints ranging from home insulation to articles for the ladies, heating manuals, slide films, sample advertising proofs, suggested radio commercials, and campaign checklists.

**Rousing the dealers to action has been a problem,** especially in promoting power choring. The larger dealers, geared to the big-name farm equipment manufacturers, are generally well-informed and more than enthusiastic about the program. But the many smaller dealers need some urging; many fail to recognize the market potential. The Council hopes its feed handling conference will put an end to that on April 29th. Scheduled for maximum attendance, it coincides with an egg-engineering day at Kansas State University. Besides short panel discussions for the farmers, the dealers will also get together and talk over their problems. This give-and-take, plus the estimated 5,000 farmers who will view the manufacturer's equipment displays, is expected to impress the smaller dealers with the size of the market, once and for all.

**"This whole program definitely helps Kansas Power & Light,"** Hinrichs told Electrical World. "We didn't do much farm promotion on our own before," he said, "now, with the Council, we are beginning to develop our own rural areas. And a desirable side result has been the improved relations with equipment dealers."

# Industry's Profit Nibblers

Report on
**Employee Dishonesty**

**This year, some $6 billion will leak out of the nation's business** into the pockets of dishonest employees. They'll nibble away about $1 billion by outright theft of cash and goods. They'll make off with the remainder in the form of kickbacks, bribes, and other underhanded forms of payola. And to make matters even more disconcerting, roughly 60% of the loss can be traced to management personnel. No business is completely immune from these hazards.

**These disquieting facts are well-known** to readers of *The Thief in the White Collar,* the story, just published, of industry's sticky-fingered employees. It was authored by Norman Jaspan, a man who makes it his business to keep abreast of such misguided behavoir. A quick check through the files of his big New York consulting firm, Norman Jaspan Associates, gives every reason to

believe dishonesty is going on, right now, in one out of every two companies. And if your utility is one of them, you probably aren't aware.

**Item: A New England electric utility.** Maintenance costs for the utility's large truck fleet were running about 80% higher than necessary. Jaspan found employees were making misappropriations of gasoline, batteries, tires, and automotive supplies. Mechanics were happy to have a little variety in their work; they fixed friends' cars on company time with company supplies.

**Item: A midwestern utility.** Construction costs for this large electric company were skyrocketing. Jaspan found phantom employees were inflating payroll costs by 10% per day. On a daily-rate basis, they would sign in, then immediately depart for another job, returning at the end of their day's work to collect their wages. They split the take; 60% for themselves, 40% for the utility job foremen who made it possible. The company's supply depot manager was also stealing; he collaborated with truck drivers, who agreed to divert some incoming supplies from the utility warehouse.

**"But it couldn't happen here; we can trust our employees."** That, perhaps, is a stock comment from management. The fact is, a company can trust its employees; the vast majority are honest to begin with, Jaspan has found. But to say and accept it so blindly raises the first red signal that trouble, more likely than not, is already smoldering somewhere in the organization. The very employees who are "beyond reproach" are usually in an ideal spot to know the opportunities for theft, carry it out unnoticed, then cover their tracks.

**Surprisingly, Jaspan attributes such misdeeds not to moral degeneration** within a company, but to outright mismanagement—thus, his company's interest, as management engineers, in the problem. With poor management, what begins as a bad habit for one man, soon becomes an accepted practice throughout a department. It may seem a minor thing—an extra half hour for lunch, pilfering of tools, padding of expense accounts, doing personal projects on company time. Or it may range to a million-dollar embezzlement, or worse. The process spreads like a disease. It feeds on lax records systems, poor communications, arbitrary policy-setting, unrealistic goals, failure to follow through on a managerial job, and general management apathy.

**Weak management soon realigns employee attitudes;** they turn from indifference to dishonesty. An employee begins to cheat a little here, a little there, until he is no longer embarrassed by his behavior. And in over half the cases, others openly support it. Soon, more employees take for their own personal gain, simply because they know management will let them get away with it.

**How can it be controlled?** Preventative management is the answer, Jaspan tells us; the breakdown in human relations that encourages malpractices need never begin. Employees who know that management cares about the way they do their jobs aren't likely to cause trouble. The answer lies in planning ahead; in uprooting malignant conditions before they breed dishonesty.

**What safeguards? Here's a quick guide.** (1) Set realistic goals that can be met honestly. (2) Maintain good communications to detect trouble before it gets out of hand. (3) Follow through on employee performance; the knowledge that work may be checked makes temptation less appealing. (4) Maintain uniformly fair policies; don't offer a man a chance to build a grudge against the company. (5) Deliberately create a few errors in your control and accounting systems (such as a false invoice figure) just to see what happens; detect indifferent and inefficient performance, a sure sign of trouble. (6) Above all, maintain checks and balances in financial operations; never put too much control in a single pair of hands.

# Bower Named President of Merrimack-Essex

Edward C. Bower (photo) has succeeded Newall A. Clark as president of Merrimack-Essex Electric Co. Clark is retiring after 39 years of service with the utility.

Bower joined the New England Electric System, of which Merrimack-Essex is a member, in 1926 at Lowell, Mass., as a student engineer. For the next several years he served in supervisory and executive posts at Lowell and with Worcester County Electric Co.

After the war he returned to NEES at Malden, and was later made vice president and assistant to the president for seven System utilities north of Boston.

In 1952, he was made responsible for the sales promotion of these seven companies, and in 1958 was made vice president and general manager of Merrimack-Essex with headquarters at Lowell.

## Chase Brass & Copper Elects Kremer Vice President

Herman H. Kremer (photo) has been elected vice president in charge of sales for Chase Brass & Copper Co, Inc, a subsidiary of Kennecott Copper Corp. In other moves, Paul M. Thomas has been appointed general sales manager, and Walter E. Evans, assistant to the president.

Kremer, who succeeds G. B. Moseley who resigned, has been with Chase for the past 15 years. He started as a salesman in New York, later becoming manager of the Charlotte, N. C., office. Then in 1956 he was made product manager for Rod and Wire at the main office in Waterbury, Conn. He was advanced to manager of marketing staff in January, 1959.

Evans has served in executive sales capacities at Chase for almost 40 years. He was most recently general sales manager.

Thomas, the new general sales manager, moves up from manager of mill sales, a post to which he was named in January of last year. He joined Chase 14 years ago and has served as district manager at Dallas and as midwestern regional manager.

## Foster and Willis Made Vice Presidents of Stone & Webster

Stone & Webster, Inc, has named Raymond C. Foster and Robert H. Willis, vice presidents.

Both had been assistant vice presidents since May, 1959, at which time they were transferred from subsidiaries. Foster moved from Stone & Webster Engineering Corp where he was engaged in engineering sales work, and Willis from Stone & Webster Service Corp where he was assistant to the president.

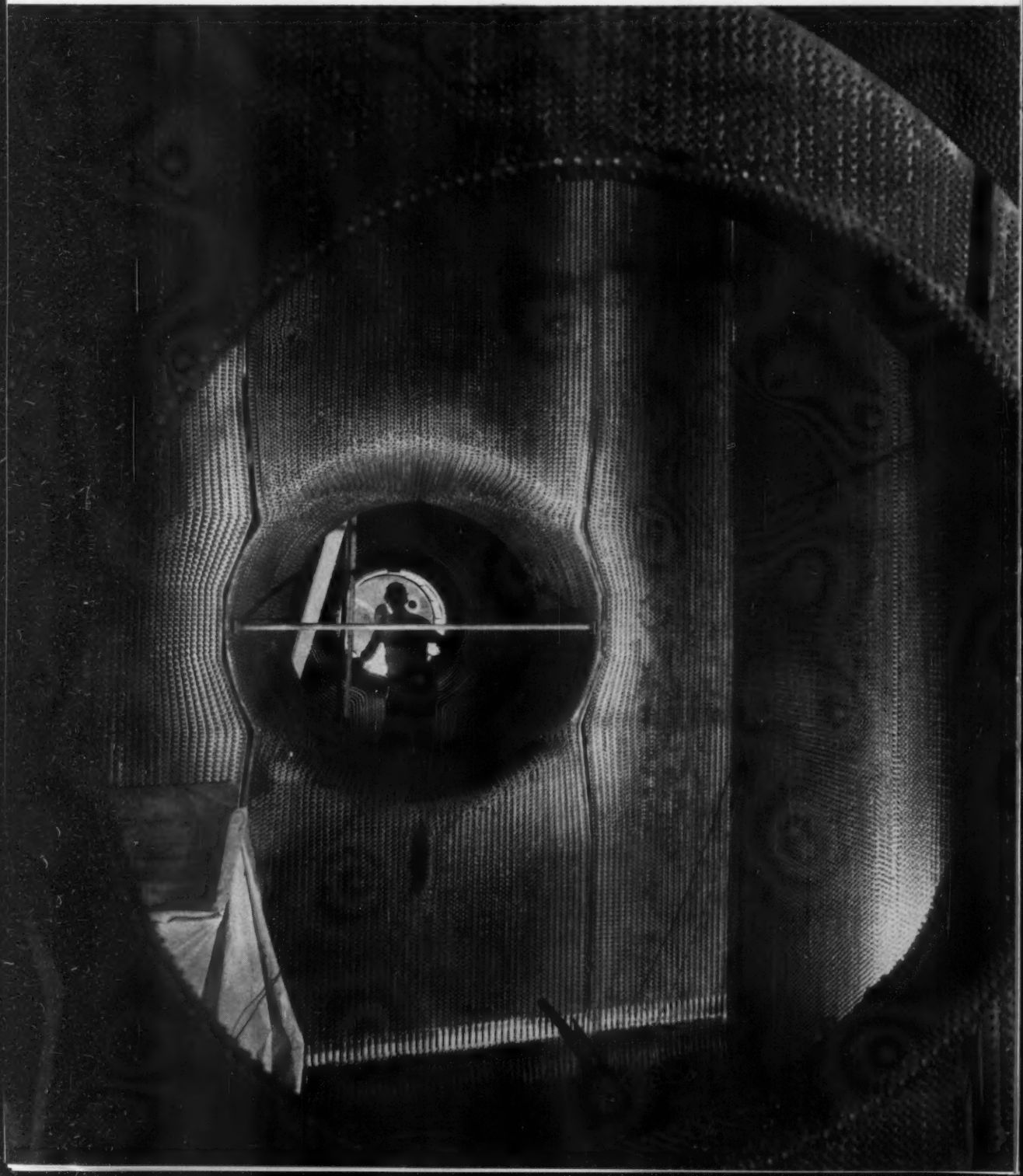
Foster joined the engineering corporation in 1946 as an engineer in the Chemical Division at the company's Boston office. He moved to the corporation's New York headquarters in 1954.

Willis came to Stone & Webster Service Corp in 1949. In 1957, he was a financial consultant in the New York office of the service corporation. In 1958 he became assistant to the president.

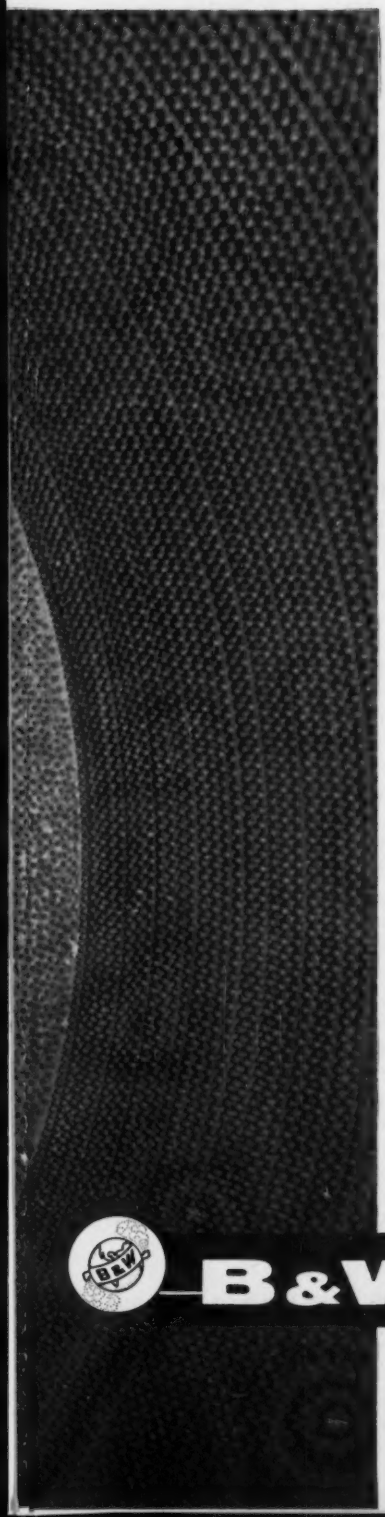
FOSTER WILLIS

(*More News About People on page* 78)

# "Cheap and dirty" coal . . .



a premium performer in the



# B&W Cyclone Furnace

**Low-cost, unwashed, high-ash coals actually aid efficient combustion in the B&W Cyclone Furnace**

Low grade coals are effectively fired in the B&W Cyclone Furnace with a continuous high velocity blast of secondary air, causing a cyclonic turbulence. Ash in the coal is melted to form a viscous fluid bed around the cylindrical furnace walls. This slag bed traps incoming coal on its surface, letting the high velocity secondary air scrub the coal, burning out maximum Btu's. More than 80% of the ash is trapped in this liquid slag and tapped into slag tanks before entering the secondary furnace.

So—the high slagging characteristics of low-cost, unwashed, low-fusion-temperature coals make them an *especially attractive* fuel!

**In addition, B&W Cyclone Furnaces offer all of the following advantages:**

- **Simplification of coal burning equipment**
- **Less atmospheric pollution**
- **Elimination of fly ash handling and disposal problem by reinjection system as a part of the unit**
- **Less space, smaller building**
- **Less maintenance and cleaning**
- **Safer operation, simpler remote control**
- **Increased availability**

The unit under construction on the left is one of the more than 325 B&W Cyclone Furnaces to be erected to meet the increasing needs for maximum efficiency of energy conversion in the power industry. We would welcome an opportunity to put the advantages of a B&W Cyclone Furnace in *your* language. For further details, please contact your local B&W representative . . . or write for B&W Bulletin G-65. Address: The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

G-965

B&W

THE BABCOCK & WILCOX COMPANY

***BOILER DIVISION***

Public Service Electric & Gas Co has made **Herman W. Grissler** assistant to the electrical engineer, electric engineering department.

**James A. Commander** has joined the special accounting department of Commonwealth Services Inc.

**Herbert P. Sedwick,** retired president of the Public Service Co Division, Commonwealth Edison Co, has received the 1960 Washington Award of the Western Society of Engineers.

Dayton Power & Light Co has named **Richard L. Stump** assistant supervisor in the overhead line department.

South Carolina Electric & Gas Co has promoted **D. Brady McKay** to district manager in Batesburg, and **N. Bryce Mack** to district engineer in the Johnston-Saluda-Batesburg areas.

San Diego Gas & Electric Co has appointed **Marvin E. Musgrave,** labor relations supervisor, and **Ronald R. Shelby,** employment supervisor.

A 12-man team has been picked as the "nucleus" to direct operations of Consumers Public Power District's 100,000-kw Sheldon Station steam power plant and the sodium graphite-type nuclear power facility. Heading up the operating staff will be **R. S. Kamber,** with **J. Denny Cochran,** assistant superintendent. Other supervisor personnel include: **L. John Cooper,** a health physicist; **Lloyd E. Keller,** chemical engineer; **Ivan Sunderman,** and **Dick Large,** performance engineers; **Gordon Ballew,** maintenance supervisor; **Glen Schukei, James Oakley, Jack Van Vynckt, Harry Hornbaker,** and **Melvin Roberts,** all shift supervisors.

**Austin O. Stewart** will head a new member-services department for Kosciusko County Rural Electric Membership Corp in Indiana.

Anaconda Wire & Cable Co has appointed **William C. Kratz** manager-magnet wire manufacturing.

**Roy M. Hukle** has been made manager of the Muskegon mill. **Richard B. Steinmetz,** president of the Anaconda Wire & Cable Co, subsidiary of Anaconda Co, has been elected to the boards of directors of Anaconda's wholly owned subsidiaries, American Brass Co, and Anaconda Aluminum Co.

**Dr Jay Tol Thomas** has been appointed director of engineering for the Boston Division of Minneapolis Honeywell Regulator Co.

**A. T. Fragomen** has been named manager of the erection department, Babcock & Wilcox Co's Boiler Division. Succeeding him as district erector in Chicago is **L. V. O'Connor.**

Austin Co has named **Rollin R. Eiber** a vice president. **E. W. Hollister** was appointed manager of the 12-state Cleveland district, and **Charles R. Wing,** southwest district manager in Houston.

**Charles W. Kalbfus** has retired from the Elliott Co after 39 years as advertising manager. He is succeeded by **Orville F. Bricker.**

Allis-Chalmers Manufacturing Co has appointed three assistant engineers: **Robert F. Alsworth,** motor and generator department; **Richard E. Birner** and **Paul Cain,** steam turbine department. Appointed to the nuclear power department as assistant engineers were: **Noel P. Grimm, Gerald C. Kutsch, Roger W. Schlicht,** and **Wayne J. Severson. James W. Adam** has been made engineering scientist in the Research Division; and **William E. Korsan,** assistant manager, and **Paul W. Clark,** manager of sales, in the industrial systems department.

Keasbey & Mattison Co has named **DeWitt W. Keach** personnel manager. **Anthony A. Lowe** has been appointed publicity writer in the advertising department.

**Thomas Hal Phillips, Norman A. Johnson Jr,** and **W. E. Moore** have been named to four-year terms on the Mississippi Public Service Commission . . . **Warren E. Waters** has been named Public Utilities Commissioner in New Hampshire.

**William E. Lett** has been named to the newly created post of export sales manager of Burndy Corp's Utility-Industrial Division.

Line Material Industries has promoted **Robert E. Olson** to purchasing agent of its central plant in South Milwaukee, Wis.

Grant County Public Utility District has named two new at-large members of the board of commissioners, **B. T. Martin,** and **Eric Peterson.**

**William W. Seifert** has been appointed assistant to the dean of the School of Engineering at Massachusetts Institute of Technology.

**C. P. Stewart** has been appointed manager, trade relations, of H. K. Porter Company Inc.

**Lee T. Bordner,** president of Sierra Electric Corp, has been elected vice chairman of the wiring device section, National Electrical Manufacturers Assn.

Yale & Towne Manufacturing Co has promoted **Gerald A. Tamblyn** to assistant general sales manager, industrial trucks of the Yale Material Handling Division.

Leach Corp has named the following as project engineers in the Inet engineering department: **Robert N. Carson, A. Richard Hammer** and **Paul E. Pazurek.**

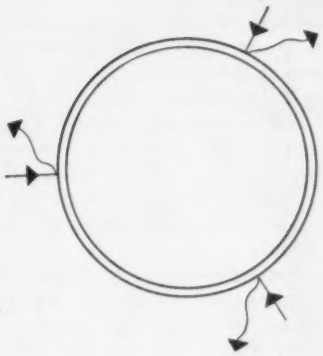
**William Deans,** vice president of I-T-E Circuit Breaker Co, has retired.

Pennsylvania Transformer Division, McGraw-Edison Co, has appointed **William I. May,** manager of small power transformer sales. Products to be sold under May's direction are the company's "Standard Parts" transformers and all other power transformers with a capacity of 10,000 kva or less.

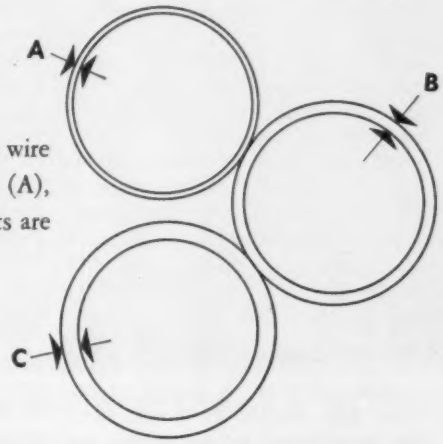
**John E. Smet** has been made assistant district manager of Elliott Co's New York office.

# BETHANIZED ACSR CORE WIRE GIVES YOU

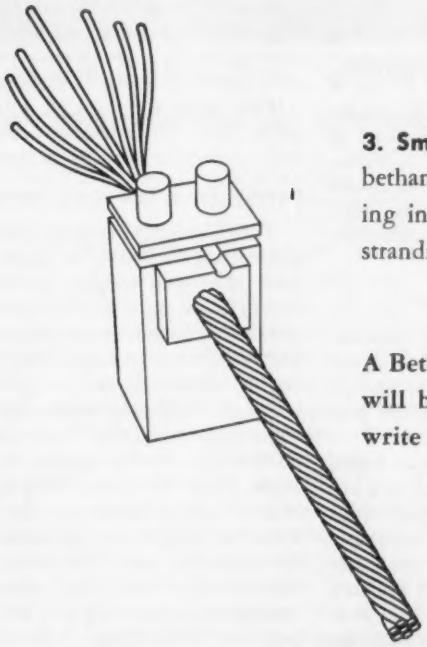
- *Dependable corrosion-resistance*
- *Choice of three coating weights*
- *Smooth zinc coating for easy stranding*



**1. Corrosion-resistance for years of added life** Our unique electrolytic process, called bethanizing, produces a galvanized wire with a uniform and tightly bonded coating of virtually pure zinc. It provides coatings double or triple the standard weight—adding years of service life to ACSR conductors.




**2. A choice of three coating weights** Bethlehem ACSR core wire is available in three weights of bethanized coatings: standard (A), heavy (B), and extra-heavy (C). All three of these coating weights are furnished in sizes from 0.1878-in. to 0.0525-in.



**3. Smooth coating for easy stranding** The smooth, uniform bethanized coating makes Bethlehem ACSR core wire ideal for stranding into standard aluminum electrical conductors. It withstands the stranding without injurious flaking or peeling of the zinc armor.

**A Bethlehem sales office is as close to you as your phone. A call will bring further information on any of your wire needs. Or write to us at Bethlehem, Pa.**

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
*Export Distributor:* Bethlehem Steel Export Corporation

**BETHLEHEM STEEL**

BETHLEHEM STEEL

## Study of 4 BWR Concepts (*Continued from page* 36)

illustrated by its substantially lesser pumping requirement for the 300-Mw plant.

### Energy Costs Compared

Capital cost variations were investigated in each of the major direct cost areas (nuclear steam supply, turbine-generator, containment vessel, base plant and land) and principal indirect and overhead costs (interest during construction, working capital and startup costs). Differential energy costs in mills per kwh were estimated for 80% load factor including fixed charges computed at an annual rate of 14% of the capital investment, fuel cycle cost, operation and maintenance cost, general and administrative expense; and third-party nuclear liability.

Table II compares all costs referred to the 300-Mw FDC plant taken as a base. Fig. 2 shows graphically the economy of the 300-Mw plant over those of lower output. The discontinuity in the curves at 300 Mw results from the change from a single-shaft turbine to a cross-compound machine required for larger saturated steam units, even at 1800 rpm.

### 300 Mw Deemed Best Now

Although there is reason to believe that further cost reductions can be achieved by still further increases above 300 Mw capacity, the savings become progressively smaller. In view of the condition for start of construction in 1960 it was considered imprudent to propose a larger unit. Futhermore considering technological limitations on the reactor and other components of the plant and the increasing uncertainty in extrapolating costs to larger sizes, it is doubtful that any savings could be realized by building a larger plant on this schedule. Reactor vessels, which are reaching the limits of shop fabrication and transportability at 300 Mw, might have to be fabricated in the field at added expense. Substantial increases in volume and pressure requirements for reactor containment would demand stress relieving to meet code requirements or use of high-strength steel, either at higher cost.

Table II indicates a range of only about 0.1 mill per kwhr among the differential energy costs for all three plants at 300 Mw capacity. Since the inaccuracy in the estimates is probably greater than this differential there is really no determination that any one cycle is cheaper.

### Single-Cycle May Compete

The apparent slight economic advantage for the dual-cycle plant as shown in Table II was not a factor in this selection since it was recognized that greater familiarity with this cycle is probably reflected in somewhat more favorable FDC cost estimates. Even though an effort was made to keep the comparison on a common basis, it is inevitable in a study of this type for a conservative approach to be taken in areas of undeveloped technology. Furthermore, engineering and design costs are higher in such areas. Accordingly, strong possibilities exist that second or third generation plants of FSC and NES types may be more attractive than the FDC plants. In smaller size units the NES and NIS may well show continuing advantages.

Hence, although the study concluded that the FDC concept offered most promise for lowest energy costs consistent with start of construction in 1960, when examined in terms of the long range future, the results call for serious additional study of the other cycles, including combinations thereof. For example, cycles which combine dual-cycle with natural or internal circulation should be combined.

### Best Pressure Determined

Steam pressure for each cycle except the NIS was studied to determine the optimum pressure and its effect on the economic values presented in Table II.

Pressure optimization was based on both differential capital and energy costs. The principal factors affecting this optimization are these:

**Reactor vessel** wall thickness was computed as a function of pressure with diameter and length held constant. Core and steam flow rates increased as pressure decreased to keep constant the available energy in the cycle.

**Steam drum** length and wall thickness were calculated to allow for flow change to provide proper steam separation area and to maintain requisite strength for varying pressure. Diameter was held constant for each plant.

**Number and size of risers** and downcomers and wall thickness were varied with allowable velocity limitations as functions of exit steam flow and quality. The driving force was also figured for the NES cycle.

**Recirculating pumps** for the forced circulation plants varied in number and capacity with demanded coolant flow. This flow must increase at lower pressures to limit the void fraction with increased steam volume.

**Secondary steam generators** were a consideration only for the FDC plant. As pressure decreased, these must handle a greater coolant flow for greater steam generation to hold generated energy constant.

**Generator and condenser:** turbine frame and exhaust areas and condenser surface area were increased to meet higher volumetric steam flow at decreased throttle pressures. Circulating water pump flow was also varied with cooling capacity for each exhaust heat load.

**Reactor feed pump and heater** duty was varied with throttle pressure according to the thermodynamic characteristics of each plant cycle.

**Fuel costs** were varied with the plant heat rate, which decreased with increasing throttle pressure.

### Curves Show Low Cost Points

The differential capital costs and differential fuel costs for each cycle were combined to give differential energy costs, mills per kwh, and are plotted as functions of pressure in Figure 3. The NES and FDC plant curves show no clear optimum pressures, being essentially flat over wide ranges. The FSC plant data do indicate a definite minimum cost point. From these data 800 psig was selected as optimum for the NES cycle, although the optimum may be somewhat below this level, and 950 psig for the FDC plant. A marked optimum appears at 1000 psig for FSC. Cycle selection results are not affected by the above optimums, since the energy cost variation from 950 psig, as shown in

(*Continued on page* 82)

# Passes even the "white glove" inspection–thanks to new standards of cleanness by Dow Industrial Service

You may never have occasion to apply "white glove" requirements to the cleanness of your process equipment, steam generators, tanks and piping. But, if you do need this high degree of cleanness, Dow Industrial Service can offer it — as an additional service — in the chemical cleaning of *your* plant equipment.

These new standards were developed by Dowell for cleaning the piping networks of the missile launching facilities at Cape Canaveral. Combining the research and engineering facilities of the entire company, new techniques, materials and equipment were perfected to meet the necessary rigid specifications.

This new service is now adaptable for use in all types of American industry. For example, an intricate cleaning job was recently performed on a 3½-mile-long buried pipeline. The customer wanted to convert the six-inch line from hydrocarbon gas to carry oxygen. For this pure product the line had to be immaculate—free of all foreign materials. The plant was faced with the alternate of laying new pipe—a six week job at a cost of $150,000.

Using the new standards of cleanness, the line was cleaned of hydrocarbon residues, carbon black, grease, mill scale, and rust. The cleaning job was done in 3½ days at a cost of $20,000. Meanwhile, plant crews made mechanical alterations to the line at a cost of about $25,000.

The job was satisfactory in every way. Inspection showed the line was free of all foreign matter. The customer credited the job with saving them about $100,000. Also the plant made additional profits because the line was put back into use so quickly.

Ask about these new standards of cleanness and their possible application to your problems. This exclusive service may save you important money. Dow Industrial Service offers the cleaning services formerly provided by Dowell. For engineered recommendations or more information, call the office or station near you. Or write Dow Industrial Service, 20575 Center Ridge Road, Cleveland 16, Ohio.

*Chemical Cleaning Services for all industry*

**DOW INDUSTRIAL SERVICE**

DIVISION OF THE DOW CHEMICAL COMPANY

DOW

**Crapo**

**GALVANIZED STEEL STRAND HAS ALL 5**

1. *Strength*
2. *Workability*
3. *Ruggedness*
4. *Long Life*
5. *Economy*

When you select a size and grade of strand for a specific job you want to know that it meets every requirement of that job. You want ample strength to sustain the ultimate load—plus an adequate safety factor. You want pliability for ease of working in the field. You want ruggedness to withstand the abuse which may be encountered during and after installation. You want long, dependable life. And, you want reasonably low first cost and low maintenance costs.

For more than 50 years *Crapo* Galvanized Steel Strand has consistently demonstrated its ability to more than meet all of these requirements. Proof of its reliable performance is to be found in the case histories of overhead power and communication lines throughout the country.

*Crapo* Galvanized Steel Strand is fully protected against corrosion by heavy, uniform, dense coatings of commercially pure zinc tightly bonded to the individual wires. All grades and sizes are available in A, B and C weights of coating.

**For details, ask our distributor or write direct!**

**INDIANA STEEL & WIRE COMPANY, INC.**
Muncie, Indiana


## Study of 4 BWR Concepts

(*Continued from page* 80)

Table II, and the optimum pressures is no more than 0.02 mills per net kwhr, a value of no real significance in this broad study.

Consideration was given to boiling water plants incorporating nuclear superheat. The incentive for nuclear superheat lies in attaining a higher thermal efficiency, hence lower fuel costs. Also the use of superheated steam with lower water rate results in less cost for the turbine, condenser and other power plant equipment. This becomes more significant as the size is increased. However a reactor system incorporating nuclear superheat is necessarily more complicated since it must contain two regions with different characteristics, one a boiling water region and the other a superheating region with the characteristics of a gas-cooled reactor. Whether these two regions are in separate reactor vessels, in distinct parts of the same vessel, or even combined into a common lattice, the cost of the reactor system with nuclear superheat is expected to be higher today than for a simple boiling water reactor.

### Conservative Approach Best

The study concluded that it would not be prudent to attempt construction in 1960 of a large plant incorporating nuclear superheat because reliable technology for extra polation is not available and the resulting plant would not yield as low a total energy cost as the simple saturated steam cycle. The more conservative approach of testing the principles of nuclear superheat in a reactor of modest proportions, although not resulting in lowest energy cost, appears preferable at today's technology.

The use of a superheater fired by fossil fuel in conjunction with a reactor producing saturated steam has often been proposed, with the argument that the incremental cost of such added capacity is relatively cheap. However, the incremental cost of nuclear capacity, which could be added simply by making the reactor larger, without resort to superheat, is probably as attractive as that gained by conventional

(*Continued on page* 84)


Two New Mineralloc Quality Products Designed for Jobs Too Heavy for Standard Jiffy Clips

**MINERALLAC Heavy Duty AND Medium JIFFY CLIPS**

Also available without mounting hole for use with gun.

patent pending

Made of heavier materials! Has exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap On" feature!

In stock in Zinc-Plated Steel for Thin Wall or Rigid Conduit up to 6". (Hot Dipped Galvanized may be obtained on order) Can be substituted for malleable clips.

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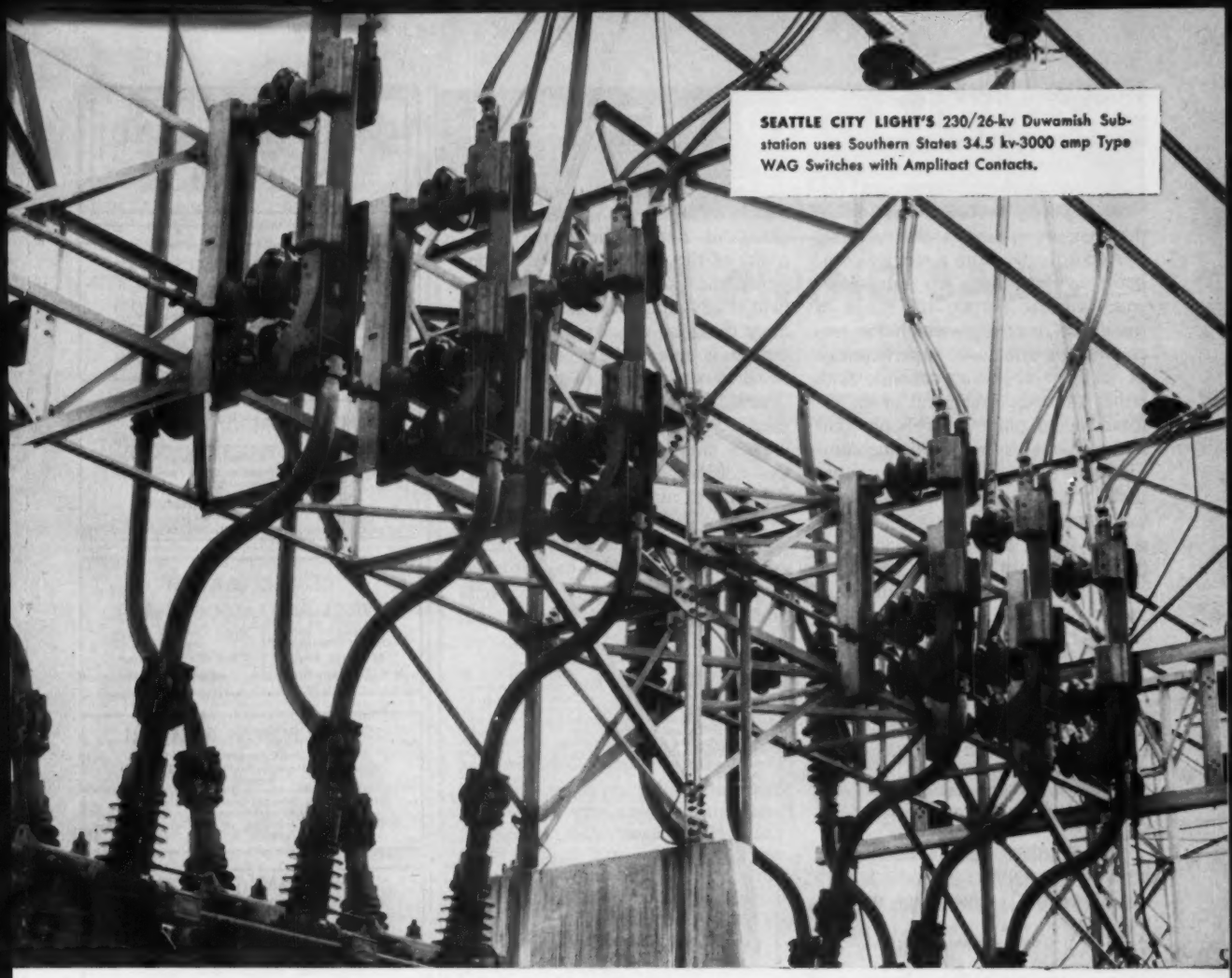

**SEATTLE CITY LIGHT'S** 230/26-kv Duwamish Substation uses Southern States 34.5 kv-3000 amp Type WAG Switches with Amplitact Contacts.

# The Man-sized Switch for Man-sized Jobs

FIG. 1

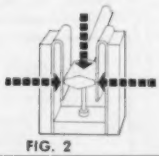

FIG. 2

### *AMPLITACT® CONTACTS ON WAG*

**High pressure Amplitact contacts provide maximum dependability under high current short-circuit conditions. The arrows in Fig. 1 show direction and relative magnitude of electromagnetic forces induced when switch is subjected to fault current.**

**The resultant electromagnetic forces, as shown in Fig. 2, greatly increase contact pressure and positively hold blade in the engaged position. For complete details, write for Bulletin 56AM on the Amplitact.**

*"Don't send a boy to do a man's job"* is a saying especially applicable when choosing switchgear that must safely carry 3000-4000 amperes. Not only must it be capable of carrying such loads after years of service, but it may be called on to withstand fault currents up to 120,000 amperes without damage.

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The Type WAG illustrated above is a good example. It's big and tough enough to carry its rated load continuously without excessive temperature rise. A built in safety factor more than compensates for the deteriorating effects of long, hard service. Amplitact® contacts provide high pressure for handling the heaviest faults.

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## Study of 4 BWR Concepts (*Continued from page* 83)

superheat. Fossil-fuel superheat requires a complete new major piece of equipment, while incremental nuclear capacity involves scale-up of the basic equipment and structures.

Accordingly, from a strictly competitive viewpoint, for plants of equal electric output, the range of fossil fuel costs for which the nuclear plant with fossil superheat can be justified as more economic than either an all-nuclear plant or an all-fossil-fueled plant is probably limited, although conceivably the combination plant could be optimum under certain circumstances. However, many other factors, such as size of plant, load factor, and cost of money enter the overall economic analysis, and until more study data are accumulated, such an economic analysis should be performed for any specific situation.

Apart from the question of economic competition, there will be situations during the development phase of the nuclear industry under which the use of fossil-fired superheat is advantageous. In a development plant for which a large reactor output is infeasible or undesirable because of the state of the art, yet desirable to match the utility company's system growth requirements and to minimize economic penalty, the addition of a separately-fired superheater may be attractive. Even in such a case, if permitted by system requirements, the same incremental power might be provided more cheaply in the next conventional unit planned for construction.

## Letters to the Editor (*Continued from page* 5)

effort in either industry or education becomes abandoned or restricted because of:

1. Operational and maintenance costs,
2. Declining management or faculty interest,
3. Decreased student interest,
4. Lack of employer interest,
5. Absence of continuing promotional efforts,
6. Inadequate presentation of existing challenges and opportunities,
7. Inadequate demonstration or presentation of progress.

These are negative or default factors which operate to deter activity in any area. They may contain a clue. If history normally repeats itself we might expect a renaissance in any field when such latent factors become favorable, positive, or dynamic.

Graduating students faced with situations similar to those mentioned in Mr. Hays' letter become alarmed at initial requirements, responsibilities, or lack of responsibilities. They become frightened by feeling themselves in competition with men having the benefit of previous manufacturing or utility experience. They require some assurance and promise wisely offered and supported. To successfully recruit new men the educational process should be continued in one form or another to attract and prepare students for a healthy atmosphere and useful work. Many progressive organizations have handled the problem very well.

Mr. Hays' letter does contain a clue to successful staff building with college material and could be a guide to making utility work attractive to our younger engineers.

Prof Stanley W. Zimmerman
6542 Whitaker Ave
Van Nuys, Calif.

## American EP Locates Plant Near Coal-Water Supply

A 265,000 kw generating station planned by American Electric Power Co is going to be located near the coal fields of eastern Kentucky, according to Philip Sporn, president of the company.

Construction is scheduled to begin June 1, and the plant is expected to go on the line in 1960. It will cost $39 million. Kentucky Power Co, a subsidiary of American, will own the plant.

Using about 750,000 tons of coal a year, the plant will make an important contribution to the economy of the area. The site is a 336-acre tract in a bend of the Big Sandy about five miles north of Louisa and three miles east of the village of Pallsburg.


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## Yankee Atomic Loading Is Ahead of Schedule

At a hearing in Washington recently, William Webster, president of Yankee Atomic Electric Co, Boston, said fuel loading of the company's power reactor at Rowe, Mass., may be completed July 1 instead of the original target date of Aug. 1.

The hearing was conducted by AEC Examiner Samuel Jensch and was concerned with technical specifications of the plant. It is being built by 11 New England utility companies under a $57-million financing program.

Webster said the plant is not expected to produce competitively priced power, at least initially. He also said that the northeastern states may become the first major area in the country where nuclear power can become competitive with conventionally produced electricity because of the region's relative distance from conventional fuel sources.

## ASCE Gives Honor to Seaway Project

Designation as the outstanding civil engineering achievement of the year has been given the St. Lawrence Seaway and Power Project by the American Society of Civil Engineers. The citation, which is the first of its kind ASCE has presented, honors Ontario Hydro and the St. Lawrence Seaway Authority in Canada, and the Power Authority of New York and the St. Lawrence Seaway Development Corp in the U.S. Plaques will be presented May 19 on the power dam.

## FPC Forecasts Power Needs To the Year 2000

In a report submitted to the Senate Select Committee on National Water Resources, the Federal Power Commission predicts that the total energy requirements for the U.S. by the year 2000 will be 4.46 trillion kwhr. Requirements for 1958 were 728 billion kwhr.

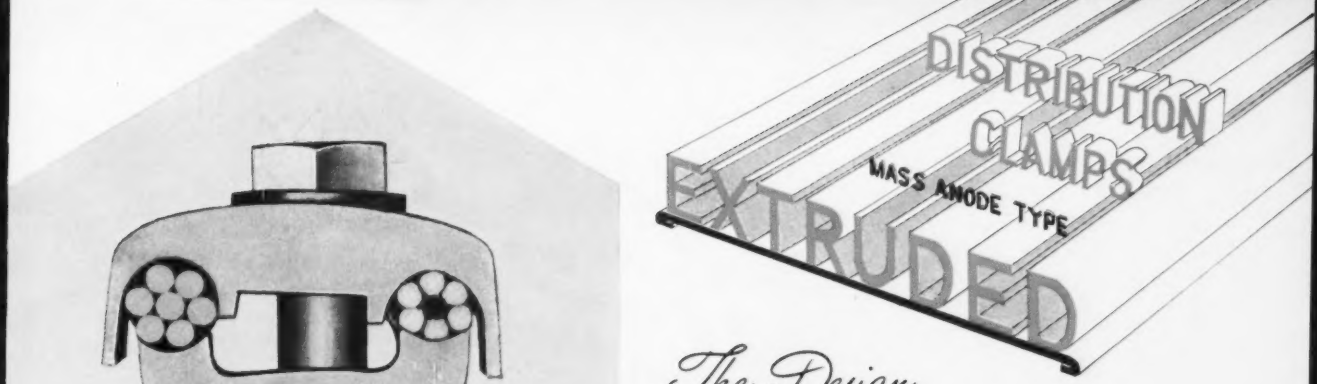
The Select Committee will publish the FPC report together with similar ones prepared by the American Public Power Association, Edison Electric Institute and some material prepared by the Secretary of Agriculture about REA.

According to the FPC report, utility generating capacity will increase from the 1958 total of 143,180,000 kw to 421,222,000 kw by the end of 1980.

Sen Robert S. Kerr, chairman of the Select Committee, requested the organizations to provide breakdowns showing the extent that demands will be met by hydro, thermal, or other source, including nuclear energy.

## Advertising Index


Allis-Chalmers Mfg. Co. ..... 51, 53
Babcock & Wilcox Co. ..... 76, 77
Bethlehem Steel Co. ..... 79
Cable Spinning Equipment Co. ..... 48
Carlon Products Corp. ..... 47
Chance Co., A. B. ..... 70
Chapman Chemical Co. ..... 66
Chevrolet Div. General Motors Corp. ..... 49
Circle Wire & Cable Sub. Cerro de Pasco Corp. ..... 45
Directory of Engineers ..... 84
Dow Industrial Service Div. Dow Chemical Co. ..... 81
Electro-Motive Div. General Motors Corp. ..... 42, 43
Elliott Co. ..... 8, 9
Engineers, Directory of ..... 84
Fanner Mfg. Co. ..... 64
General Electric Co. Apparatus Dept. ..... 2nd Cover, 10, 41
Graybar Electric Co., Inc. ..... 7
Highway Trailer Co. ..... 52
I-T-E Circuit Breaker Co. Victor Insulators Div. ..... 65
Indiana Steel & Wire Co., Inc. ..... 82
Joslyn Mfg. & Supply Co. ..... 19
Kearney Corp., James R. ..... 6
Kerite Company ..... 22
Lapp Insulator Co., Inc. ..... 4
Line Material Industries ..... 15, 16, 17
Mineralac Electric Co. ..... 82
Moloney Electric Co. ..... 4th Cover
Natvar Corp. ..... 18
Osmose Wood Preserving Co. of America, Inc. ..... 64
Pennsylvania Transformer Div. McGraw-Edison Co. ..... 20, 21
Reliable Electric Co. ..... 3rd Cover
Sangamo Electric Co. ..... 46, 68, 69
Searchlight Section ..... 85
Southern States Equipment Corp. ..... 83
Wagner Electric Corp. ..... 67
Westinghouse Electric Corp. ..... 55, 56, 57, 58, 59, 60, 61, 62
PROFESSIONAL SERVICES ..... 84
CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.
EMPLOYMENT OPPORTUNITIES ..... 85
EQUIPMENT (Used or Surplus New) For Sale ..... 85



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Body and bridge align themselves to contain and contact all strands. All conductor combinations, even one max. and one min., are contacted with pressures exerted in *exact* opposite directions (always toward the core). Conductors are never distorted.

## The Material

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| No. 356 — Aluminum | Die Casting | 41 |
| Alum Brz. (90 Cu., 8.9 Al., 1.0 Fe) | Casting | 12.6 |
| Copper Conductor | Draw | 97 |
| Aluminum Conductor | Draw | 61-62 |

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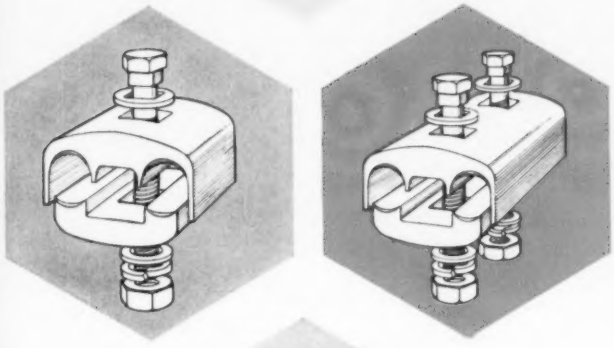

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## The Bolt

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## Types

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| LINE | TAP |
|---|---|
| 1/0-8 | 1/0-8 |
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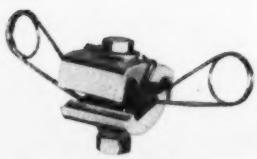

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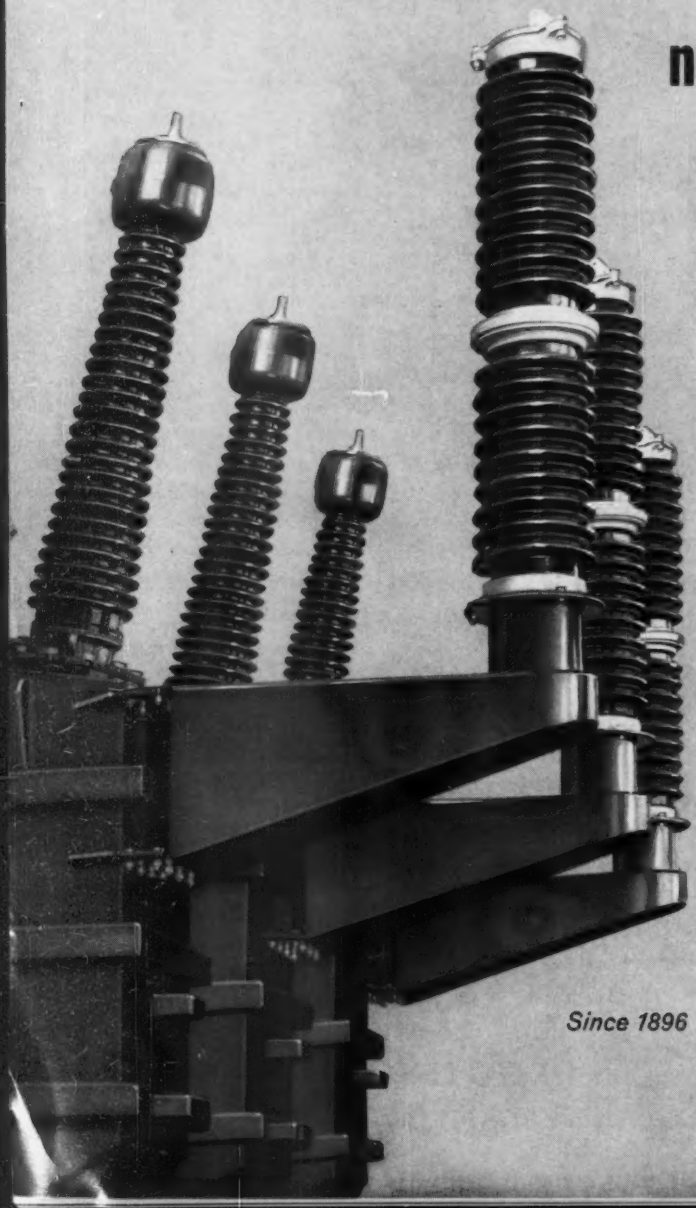

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